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The Easterly Extension of the Jerome Park Reservoir, New York.

About half of the Jerome Park reservoir of the New York water supply works has reached what may reasonably be termed completion. At any rate, its condition is such that water has been turned into it, although to a small amount only. After its years of waiting, the city is to be felicitated upon this result, but the problem of the Eastern basin still remains to be treated, the term problem being used advisedly. When the Jerome Park Reservoir was first designed the filtration of public water supplies had received but scant consideration by more than a few of the more advanced communities of this country. At the present time, however, that condition has so radically changed that the filtration of all the water for the Boroughs of Manhattan and The Bronx is assured in the near future. It is that one of the works connected with the water supply of the City of New York which will undoubtedly be reached more quickly than any of the larger undertakings now in view for the city. The Aqueduct Commissioners have already given it serious consideration and the Commissioner of Health has declared for it in the most outspoken and vigorous terms in his last report. Under such conditions the plans for the completion of the Eastern basin of the Jerome Park Reservoir acquire a greatly enhanced importance.

Within the past year, both the former chief engineer of the Aqueduct Commission, Mr. J. Waldo Smith, and the reconvened Board of Additional Water Supply for the City of New York have reported strongly in favor of suspending the work on the Eastern portion of the reservoir until the whole question of filtering the water supply of the Boroughs of The Bronx and Manhattan is definitely determined. Both Mr. Smith and the Board of Additional Water Supply stated with much force that the portion of the city to be served by the Jerome Park reservoir would be completely served for the present by the completion of the Western basin, which will be filled for use by the end of the present year, or before. They also stated that it would be a waste of public funds to complete the Eastern portion of the reservoir on plans which would render it entirely unsuited to the reception of filtered water, which requires a completely covered reservoir for its storage.

Agreeably to the tenor of these reports the Aqueduct Commission submitted an official inquiry of the Corporation Counsel for the purpose of ascertaining whether under the law creating that body it could undertake the construction of filters for the Croton supply. The Corporation Counsel gave an adverse opinion, stating that the Aqueduct Commissioners were not clothed with authority for that work. There is great doubt whether the position taken by the city's legal adviser is tenable. Whether that be so or not, however, the Aqueduct Commissioners were effectually estopped from proceeding with the work. On the other hand, public sentiment not only favors filtration but demands it, and the Commissioner of Health states in the most emphatic manner that it is absolutely essential for the public health. Every feature of the situation in the City of New York bearing upon its public water supply indicates that whether the Aqueduct Commissioners now have power to construct filtration works or not, the Croton water must be filtered in the near future, and practically the same observation is applicable to the additional supply about to be secured by the plans recently approved by the Board of Estimate.

It is understood that the question of completing the Eastern basin of the Jerome Park Reservoir is again before the Aqueduct Commissioners. The duty of that body seems to be perfectly clear. Obviously that portion of the reservoir should not be completed until it is definitely known what kind of water it is to receive, and on that point there is practically no room for doubt. It will be but a comparatively short time before the distributing reservoirs of the city must be prepared for the reception of filtered water, and a large sum of money besides much valuable time can be saved by suspending all further work on the Eastern basin until its plans can be so changed as to make it a covered reservoir. Whether the Aqueduct Commission has power to construct filtration works or not is beside the question. The city needs filtered water from the Croton supply and it is bound to have it with very little delay. Public sentiment and the best engineering authorities of the city have declared for it. The duty of the Aqueduct Commissioners is, therefore, a simple and plain one in leaving the way open for the completion of the Eastern basin agreeably to the interests of the public and the best water supply practice of the present day.

Possible Evaporation.

Now that very strong claims are made for the evaporation obtained in certain types of boilers, it is not out of place to consider what is the best possible performance of a boiler working under favorable conditions. There are two ways of considering this subject. In the first, if the percentage of efficiency of a boiler and the total heat of combustion of the coal are known, the evaporation can be at once computed. The result, expressed in pounds of water from and at 212°, is simply the product of the heat of combustion and the decimal fraction representing the efficiency, divided by 966. Assuming a grade of coal to be used which has been found by calorimeter trial to give the highest value of any that has been obtained, and also assuming a percentage of efficiency, based on the results of authentic tests, which accords with the highest records, it seems reasonable to expect that a combination of the two will give a figure of evaporation, which, under proper conditions, can be realized in actual work. For example, there are grades of the semi-bituminous coals which give a total heat of combustion of 15,400 B. t. u. per pound of combustible. With fuels of this class authentic trials have occasionally shown that an efficiency of 80 per cent. is attainable in boilers which are properly equipped for burning the coal and are operated under suitable conditions. Using these data it appears that an evaporation of $15{,}400 \times 0.8 \div 966 = 12.75$ lb. may be fairly expected, if the conditions accord with those proved by authentic trials. In selecting these data, extreme figures have not been taken, for there are trials on record showing even higher efficiency than the 80 per cent. that has been taken.

In the other method of treatment, the problem is to ascertain the maximum possible efficiency which can be obtained under practicable conditions. It is necessary to examine those losses which cause the efficiency to fall below 100 per cent. and to see how far they can be reduced. Of the 20 per cent. loss mentioned in the example just given, the main factors are losses by radiation, unconsumed gas, and heat carried into the chimney. In good practice the radiation probably causes a loss of 3 or 4 per cent. The burning of hydrogen in the fuel causes a loss of 3 or 4 per cent. more, owing to the sensible and latent heat absorbed by the water resulting from the combustion. Assuming that each pound of combustible produces 16 lb. of gas, and that the temperature of the flue is 400° above that of the entering air, both of which are within the range of good practice, the loss from this source is $16 \times 400 \times 0.24 = 1{,}536$ B. t. u., or about 10 per cent. The loss from unburned gas makes up the remaining 2 to 4 per cent.

An improved efficiency is attainable by preventing radiation, reducing surplus air, lowering the flue temperature and making the combustion more complete. All of these are possible, to judge from the examples afforded by individual results in respect to each. For an addition of 2 per cent. to the efficiency, the evaporation is increased about one-third of a pound. Starting, then, with 12.75 lb. as a result obtained under conditions of established practice, it is not beyond the range of reasonable expectation to look for 13 lb., or perhaps a trifle higher figure, as the possible evaporation where every circumstance favors economy.

Cost Keeping on Civil Engineering Works.

The papers and books on methods of keeping itemized records of costs in shops are very numerous. It is acknowledged that the greater the detail of such records, provided the classification of items is logical, the greater is the amount of information furnished concerning expenses and the ways of curtailing them or of getting a larger return for the same money. In civil engineering works, however, the value of itemized accounts has only recently been recognized, except by a few people. The contractor has nothing to sell when his work is done, except a structure which will probably never be duplicated. In building this structure his profits lie mainly in ability to handle labor well and to provide the plant best adapted for the conditions. He believes himself competent to judge how men work by watching them occasionally, while the idea that the cost of running his plant should be itemized seems absurd to him. He pays a certain amount for fuel per week and in that time a certain amount of material is handled, and he cannot understand the value of anything more detailed.

For a number of years this journal has insisted that in civil engineering construction, just as in shop practice, the costs should be itemized according to operations performed as well as to product, and that the cost of running a plant should be treated in the same way. A few contractors have had such a system for some time, one large company for more than twenty years, but as a rule it is considered impracticable or needless expense. This is incorrect, and those who desire to investigate the subject will find it fully explained in Mr. H. P. Gillette's "Handbook of Cost Data," which is reviewed elsewhere in this issue. The book outlines in so much detail what is meant by itemized costs that it is unnecessary to go into the subject at any length here. A few of the particular instances the author mentions deserve notice, however, as explaining what is meant.

The first case that illustrates what is meant by the unit system was a dam having heavy dimension masonry. The time-keeper was required to measure the dimensions of each block of stone as soon as it was dressed, and paint a distinctive letter and number on an end face. This reference mark was entered in a notebook opposite the dimensions of the stone. As fast as the stones were laid in the dam each mason in charge of a derrick gang was required to mark on a card the letter and number of each stone. When this card was turned in at the end of the day, it was possible to compute the yardage of cut stone laid by each gang, by referring to the time-keeper's records giving the dimensions. It will be noticed that by this simple expedient Mr. Gillette was able to compare the daily work of each gang and also keep track of the quarry output.

A totally different example is afforded by a method of recording the work done by each team in hauling broken stone. Each teamster was given each morning a card ruled vertically and horizontally so that a punch mark in any of the squares indicated within 5 minutes a definite time of day. A man at each end of the haul was given a conductor's punch, the two cutting holes of different shapes. In this way the card of each teamster was punched in such a way that the time on which he left each end of the haul was recorded without any of the trouble of writing. The drivers were spurred to do a full day's work by the knowledge that the time of each one was accurately kept. The cards also showed where time was lost needlessly. Mr. Gillette states that he learned from these cards that much time was being lost at the rock bins, and he accordingly made changes in them that avoided much expensive delay. The teams were all hired and the drivers were not a very active lot of men, but the introduction of the record cards increased the number of loads hauled daily by 25 per cent., without in the least overworking the horses.

The third case illustrates the value of observations of the time consumed in certain operations. By means of a watch the exact time at which a cableway bucket began to rise from the pit was noted, the time at which it was out of the pit and began to travel along the cable, the time it reached the dump, and so on for the round trip. A considerable number of such records gave an accurate average timing of the work of that cableway, under the conditions on the work, and furnished information for a pretty fair estimate of the time necessary for work under different conditions. Considerable criticism has been made of the value of data collected in this way, on the ground that they do not allow for various delays, but when the information is employed with a full understanding of the way in which it was obtained it cannot fail to be highly useful.

These few instances explain fairly well the great difference between systems of cost-keeping which show only the price of work per unit of quantity and those which show the cost of each item of the operations that are performed in executing the work. It is only by keeping the latter class of records that an engineer or contractor can estimate future works with fair accuracy, for he can otherwise guess at the effect of changed conditions.

The Arch.

Although the arch is the oldest type of bridge construction, it experienced little or no development until the last ten or twelve years, but its recent rapid growth in favor makes it desirable to point out again some feautres of such structures which were discussed in this journal a number of years ago. The oldest examples are characterized by shorter spans and cruder features of construction than are found in modern masonry arches, but as types of a system, the later structures exhibit little if any development from some of the oldest now in existence. During the past century the theory of the inelastic arch has certainly been developed far beyond the elementary ideas which governed the design of the oldest masonry arches, but the older builders—the successful ones—produced in a number of instances nearly or quite as satisfactory works by dint of untrained genius as the later engineers guided by well-developed theory. The older successful works, however, failed to show the same degree of economy as the more scientifically designed arches of comparatively late date. These observations apply wholly to the masonry arch, which has been and still is generally regarded as composed of a series of rigid or inelastic exact-fitting stones, with the line of resistance to be found anywhere within safe limits in the interior of the arch ring.

The chief development of the arch has proceeded from the application to it of the principles of elastic flexure. It is true that the employment of pin or similar joints at the crown or springing introduces an element of precision or control of the line of resistance which may be considered to some extent an advance on the old theory; but it is in reality an incident of the latter and can scarcely be called a development from it. The real development in arch design began with the application of the theory of elastic flexure to the arch theory. The arch ring, constructed of suitable metal, or a combination of concrete and metal, became the arched rib, and thus was taken the first long stride in the real development of the arch. It was no longer necessary, for the line of resistance to pass through or be fixed in the middle third or any other particular portion of the arch ring, although a certain degree of economy might be attained by such a restricted location. The placing of the line of resistance even outside of the rib simply means that the latter would be subject to flexure which can be resisted safely by a proper disposition of metal. In other words, the arch must resist a combined thrust and bending.

Again, the capacity of resisting flexure possessed by the arch rib introduces the necessity of recognizing the condition of the structure at all points, or at any rate at those points where the capacity to resist flexure fails. If the rib has its springing joints firmly fixed, as Captain Eades intended should be in the case in the St. Louis Bridge, the analysis is based on an unrestricted capacity to resist flexure at those points. If, on the other hand, there are pin joints at the springing of the arch, as in the Washington Bridge over the Harlem River, or at the crown, as in the three-hinge arch, the analysis must be so conditioned as to make bending moments zero at those points whatever may be the condition of loading. The pin joints, wherever placed, simplify the theory on account of the additional equations of condition which they produce, and by which unknown quantities may at once be found. It is clear, therefore, why the development of the arch theory has brought into existence the metallic arch rib, first in cast iron and then in wrought iron and structural steel. The old idea was that of an arch in which compressive stress alone is found while the developed or modern idea is that of an arch in which both tension and compression, and hence shear, may be found.

Obviously the capacity of the rib to resist shear offers an option between a solid web or an open one of braces. The older cast-iron ribs, like the latest Alexander III. steel cast rib in Paris, were constructed with solid or continuous ribs, while many modern instances exhibit open webs of braces, prominent among which is the Clifton arch rib designed by Mr. L. L. Buck, M. Am. Soc. C. E. The choice between the open and solid web is affected by the depth of the rib and other considerations. Properly designed, either may be satisfactory, but where it is practicable the solid web will yield the most substantial structure. The latter is admirably exemplified by the Washington arch over the Harlem River, where the type was adopted for a span of more than five hundred feet with eminently satisfactory results. The development of the arch theory has not only led to a much more scientific design, both for the arch in masonry and for the arch rib, but it has also led to an arch structure adapted to greatly increased spans. The Clifton arch rib at Niagara, with its span of over 800 feet, is a marked instance of this fact, and the limit of desirable application is far beyond that span. The general type of structure which includes the arch rib includes also the stiffened suspension bridge, and the general theory of the type is identical for both. The rib is a stiffened set of compressive members while the suspension bridge is a stiffened set of tension members. Both are adapted to long spans. The main stresses of the structures are direct or longitudinal to the members which carry them, necessitating light bracing members and leading to precisely the condition of economical use of material imperative for long spans. Since compression members require much more bracing than those in tension, and in general carry materially lower working stresses, it is evident that the stiffened suspensioned system is peculiarly adapted to the longest span, although the arched rib is economically adapted to far longer spans than any to which it has yet been applied. The chief function of the arch rib, or stiffened arch, however, may be regarded as the displacing of the inexpressibly ugly truss and cantilever wherever practicable by one of the most graceful bridge structures which civil engineers have yet designed.

Notes and Comments.

A Forty-Mile Pipe Line to furnish water to construction camps upon the eastern end of the Western Pacific Ry. is being installed by the Utah Construction Co. Water will be secured at a spring in Skull Valley, and pumped to the edge of the Great American Desert, requiring three pumping stations to overcome local elevations.

All Masonry Structures on the Eastern, Middle and Detroit divisions of the Wabash R. R. have been let to one contractor annually for a number of years past. He has a quarry which furnishes most of the stone for these works, and, consequently, has a large amount of rubble unfit for other use than bedding in concrete. The company accordingly allows him to use this stone in certain classes of concrete structures, thereby getting a low figure on all concrete masonry.

Muffling Tanks to quiet the noise of exhaust steam are sometimes needed, as was the case in an office building some time ago. A 10x12-in. engine running at 250 r.p.m. had an exhaust pipe that made a number of sharp turns before entering a riser surmounted by an exhaust head. The noise was so serious that the tenants threatened to leave if it was not stopped. The remedy was merely a plain shell having a volume twenty times that of the cylinder of the engine and inserted in the exhaust pipe at the first turn nearest the engine.

The Stone Industry in the United States last year had a generally successful season, according to the figures of the United States Geological Survey. The granite output was worth $15,604,000, $1,466,000 over the output of 1903. The trap rock products in 1904 were worth $2,824,000, a gain of $91,000. The marble products of 1904 were valued at $6,298,000, $935,000 more than those of the year before, while limestone remained practically unchanged at $31,996,000. Sandstone, including bluestone, decreased from $11,262,000 in 1903 to $10,296,000 in 1904, and slate fell from $6,257,000 to $5,617,000. The stone industry as a whole increased from $72,946,000 in 1903 to $74,200,000 in 1904.

The Lewis and Clark Exposition deserves the careful attention of showmen, for when it closed its doors a little while ago it had a surplus of between $100,000 and $125,000, which will be distributed among the stockholders. Such a financial condition is contrary to all precedent, and, it must be confessed, is a little disappointing to those who feel that expositions are considerably too numerous now. If by any chance they become profitable to the stockholders the imagination cannot picture what may happen. The Lewis and Clark Exposition was a plucky undertaking for Portland, however, and had a purpose which was worthy of the support it fortunately received. The Pacific coast is bound to develop far beyond its present condition, both commercially and in manufacturing, and the Exposition did good work in attracting to this delightful section of the country many people who would otherwise remain ignorant of its resources.

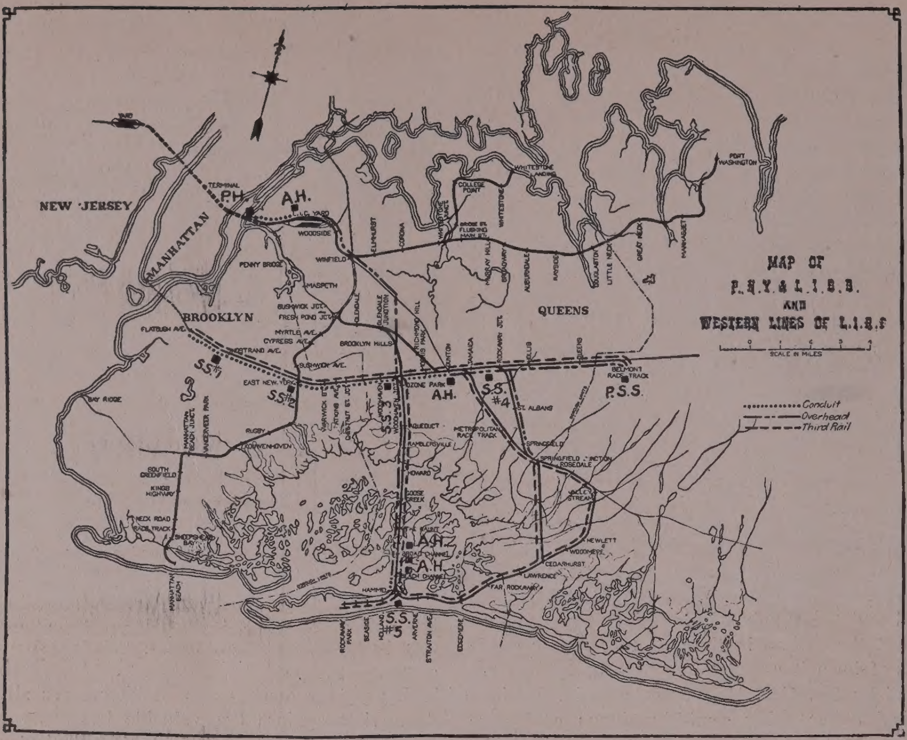
The Reclamation Service Contracts are estimated by the engineers engaged in that work on a basis which they consider ample for a reasonable profit. Usually they have been troubled more by very low tenders than those that are too high. Recently they have received tenders for one piece of work, the completion of the Gunnison tunnel in Colorado, which were so much above their estimate that it has been decided to do the work by day labor. This is a large undertaking, costing somewhat over a million dollars, and it will be watched with much interest by contractors who have been criticizing the estimates of the engineers of the service. In one particular these contractors are unquestionably correct in their criticisms, and that is the cost of concrete in the next few years. For some time past cement has been sold at a ridiculously low figure. The price has hardened a little of late, but it will soon rise much more unless all signs change, and consequently concrete will be somewhat more expensive.

Heavy Fires in a boiler furnace sometimes produce conditions comparable in a degree with those attending the operation of a gas producer. In these a thick bed of incandescent coal is provided and the supply of air reduced, in order to convert the carbon in the coal to carbonic oxide and not burn it completely. In a boiler test reported by Mr. Geo. H. Barrus, a 12-in. fire in a vertical boiler using semi-bituminous coal gave a flue-gas analysis of 6.8 per cent. carbonic oxide, 1.7 per cent. free oxygen and 11 per cent. carbon dioxide. When the thickness of the bed of coal was reduced to 6 in., the same boiler showed a reduction of the carbonic oxide to one-half of one per cent., an increase in the free oxygen to 3 per cent., and an increase in the carbon dioxide to 16 per cent. In this case, the loss of heat from the imperfect combustion of the carbon to carbonic oxide represents with the heavy fire 25 per cent. of the total heat of combustion of the coal, while with the thinner bed of coal the loss is below 2 per cent. This improvement was not attended by a serious increase in the amount of surplus air, for in neither case did it exceed 25 per cent.

Charges for Plans and Specifications sent to contractors at their request, in order that they may prepare tenders, are perfectly justifiable provided these charges are refunded on receipt of a bona fide bid. This cannot be said, however, of the practice of inviting contractors to bid on work and then charging from $10 to $50 for plans and specifications, without a rebate when they are returned. The amount is not large, it is true, but it is difficult to see the justness of requiring a contractor to pay for plans and specifications in order that an owner may have competition. There is no reason why an engineer or architect should carry the expense of getting out these duplicate plans and specifications, but the owner certainly should. The cost of preparing an estimate of a large office building may run up to several hundred dollars, and this expense the contractor is perfectly willing to bear, but when, in addition, he is asked to pay for the data for such estimates, made at the request of owners in many cases, he naturally feels he is imposed on. The reason for making the charge seems to be to avoid the annoyance that comes from the flood of requests for specifications of important work. Life will always have such annoyances, however, and it is a good plan to make up one's mind to that fact. To avoid this particular source of trouble by an injustice to contractors seems an unprofessional and unbusinesslike proceeding.

The Vertical Boilers in the Hotel Gotham, in New York City, described elsewhere in this issue, furnish an important novelty in the mechanical installations in large buildings. This branch of engineering rarely offers any real novelty like this, for only a few engineers are making a specialty of it and these few find that the standard methods and equipment can be made to fit most of the problems presented for solution. The problem in the Hotel Gotham was decidedly unusual, and the engineers were enterprising enough to meet it by some other method than juggling with the old ideas. This hotel is unexcelled for the sumptuous character of its appointments; everything that money could provide for the comfort of the guests has been furnished. But money could not provide more room for mechanical plant than was furnished by the lines of the property on which the building stands, and the ordinary arrangement of boilers, engines and other equipment was simply impossible unless the machinery was huddled together in a way preventing good management and ready repairs. As the boilers could not be spread out horizontally, the engineers ran them up virtically two stories, using for the purpose the well-known type of boiler designed by Capt. Charles H. Manning, superintendent of the Amoskeag Manufacturing Co. In this way they not only installed a large plant on a small ground area, but they also were able to arrange a great variety of apparatus in a compact yet accessible manner. Inasmuch as both property owners and architects are already demurring against the valuable basement space occupied by mechanical plant, this particular installation must be regarded as an important novelty deserving careful consideration.

The Panama Canal was the subject of some comments by President Roosevelt in his speech at Jacksonville, Fla. These were so thoroughly descriptive of a certain class of critics of that enterprise as to merit careful consideration. He said: "The work is as difficult as it is important; and it is of course inevitable that from time to time difficulties will occur and checks be encountered. Whenever such is the case the men of little faith at home will lose that little faith, and the critics who confound hysteria with emphasis will act after their kind. But our people as a whole possess not only faith, but resolution, and are of too virile fiber to be swept one way or the other by mere sensationalism. No check that may come will be of more than trivial and passing consequence, will inflict any permanent damage or cause any serious delay. The work can be done, is being done, and will be done. What has already been accomplished is a guarantee as to the future. When any such work is undertaken there are always many mere adventurers who flock to where it is going on, and many men who think they are adventurers, but who are in reality either weak or timid, follow in their footsteps. Some of the first class will now and then cause trouble in one way or another. But every care will be taken to detect any misdeed on their part and to punish them as soon as the misdeed is detected. As for the second class, they will cause trouble chiefly by losing heart, returning home, or writing home, and raising a cry that they are not happy and that the conditions of life are not easy, or that the work is not being done as they think it ought to be done. Now, these men stand just as the stragglers and laggards stand who are ever to be found in the rear of even a victorious army. The veterans of the Civil War who are here present will tell you that the very rear of an army, even when it is victorious, is apt to look and behave as if the victory were defeat. And just the same thing is true in any great enterprise in civil life; there are always weaklings who get trampled down or lose heart, and there are always people who listen to their complaints. They amount to nothing one way or the other, so far as achieving results is concerned, and their complaints and outcries need never detain us."



Electrified Railways on Western Long Island.

THE ELECTRIFICATION OF THE LONG ISLAND RAILROAD.

The Most Important Electrification of a Steam Road Now Operating.

The electrification of the Western Division of the Long Island R. R. is one of the most interesting events that has taken place in railway affairs for many years, especially to those who recall the discussions of electric train operation that occurred about ten years ago. It is not necessary to harass the feelings of esteemed contemporaries by referring to editorials they published proving that the electricfication of this particular division would never occur. It has occurred in spite of their prophetic spasms, and deserves careful study.

The Western Division of the Long Island R. R. consists of numerous lines within the limits of the city of New York, and while the main terminus of the road is in Long Island City, opposite 34th St., in the Borough of Manhattan, the road has another very important terminus at the intersection of Atlantic and Flatbush Aves. in Brooklyn. The line to the latter terminus is four-tracked from Jamaica to East New York, thence double-tracked through Atlantic Ave. to Flatbush Ave. It originally traversed open farming country, but the enormous growth of the outlying districts of the Borough of Brooklyn has resulted in the building up almost solidly of the section traversed by the railway line from Flatbush Ave. out to East New York. and even beyond as far as Atkins Ave., a distance of 5¼ miles. On agreement with the city, dated May 18, 1897, the railroad company undertook to remove its tracks from the surface of Atlantic Ave. and to operate passenger trains on the line by a motive power not requiring combustion. This requirement obviously pointed to electric traction, and the planning of a satisfactory train service for this short section has resulted in the installation of the most extensive system of electrification yet put in operation on any steam railway in the world.

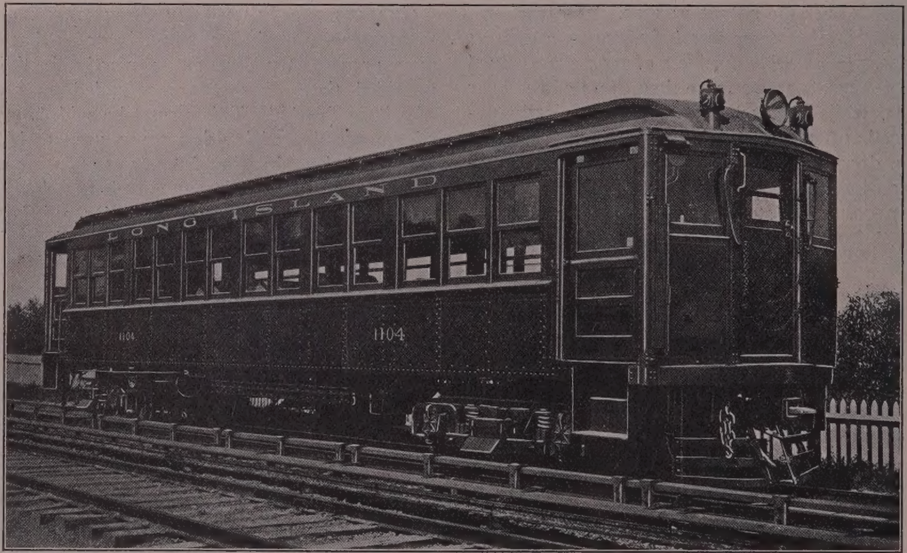
Nature of Traffic.—As before stated, the Long Island R. R. at the extreme west end of the island, consists of a network of lines, having two important city terminals, and conducting a heavy through as well as local service. By reference to the map, it will be seen that the Flatbush terminal is in the heart of Brooklyn, and connects at that point physically with the Brooklyn Rapid Transit elevated lines leading to the Brooklyn Bridge and to the Broadway Ferry. It will also soon connect with the subway and tunnels being constructed by the Interborough Rapid Transit Co. from the Battery, in the borough of Manhattan, under the East River, and thence to Flatbush and Atlantic Aves. It will be seen that upon completion of the subway tunnel, passengers arriving at the Flatbush Ave. terminal from points on Long Island will have a short and direct route to the lower business section of Manhattan Island by either the subway or by elevated lines over the Brooklyn Bridge. Furthermore, direct connection will be established by the elevated lines over the new Williamsburg Bridge.

The regular service on the Atlantic Ave. line consists not only of suburban trains carrying passengers from towns on the south and north shores of the island, but also quite heavy local business from Flatbush Ave. out to Jamaica, and very heavy excursion business to Rockaway Beach, the Metropolitan race track near Springfield, and those located at Aqueduct and Belmont Park.

Extent of Electrification.—Considering the complicated train service above referred to, it was obviously impossible to adopt an electrification plan which contemplated electric haulage for part of the journey and steam haulage for the remainder of the journey to the principal points —beaches and race tracks—inasmuch as the transfer of passengers en route to those points would occasion endless confusion and delay. It was therefore determined, in spite of the fact that immediate return on the very heavy outlay could not be expected, to electrify all lines leading out of the Flatbush Ave. terminal upon which heavy suburban or excursion business took place. This resulted in practically the electrification of the entire road south of Atlantic Ave. and the main line out to Queens, and as far east on the Montauk Division as Valley Stream. It was not found necessary to electrify the line north of this dividing line, as no through traffic from Flatbush Ave. to the terminal in Long Island City at present exists. When the tunnel lines to the borough of Manhattan, now being constructed by the Pennsylvania Railroad Co., are completed, a new set of conditions will be introduced, which will require very considerable extension of the electric service, and will no doubt comprehend at that time all the lines of the company for, say, 25 miles out of both terminals.

Inspection of the map accompanying this article will illustrate the present system of electrification and its relation to the complete system.

The diverse character of the train service and its very fluctuating loading at different seasons of the year, due to the character of the excursion business, formed conditions the reverse of favorable for economical electric traction, for the reason that the load factor on any of the fixed portions of the complete system, as power house and transmission lines, would necessarily be a very low one throughout the year. In spite of this very great handicap, which meant an enormously heavy initial expenditure, the management of the railroad company determined to provide complete electric service at the outset, having faith that the improved facilities afforded would result in the growth of the territory adjacent to their line, and in the end afford them a fair return on their investment. It must be confessed, however, that for the present, and



Third Rail and Car Used on Long Island R. R.

probably for some time to come, the expensive pioneering done by the company will result chiefly in increased convenience to their patrons rather than in enlarged net revenues.

Under normal conditions the loading of the power plant and sub-stations will be comparatively light, but in order to take care of the heavy race track and excursion movement, a power capacity has been installed sufficient to move simultaneously the following service:

Flatbush Ave. to Belmont Park.—Fifteen six-car trains per hour in each direction.

Flatbush Ave. to Rockaway Park.—Three six-car trains per hour in each direction.

Valley Stream to Hammels.—Two four-car trains per hour in each direction.

In addition to the above, power is supplied for the trolley car service between Rockaway Park and Jamaica.

System Adopted.—A decision upon the character of the equipment and the characteristics of the electrical apparatus involved reference to the possibilities of connecting with the lines of neighboring companies, including the Brooklyn Rapid Transit Co., the Interborough Rapid Transit Co. and the Pennsylvania R. R. tunnels, as well as the physical character of the lines of the Long Island R. R. itself. In coming to a decision upon the work, therefore, operation over elevated lines, in subways, on the surface, and also in the Pennsylvania R. R. terminal and tunnels, had to be harmonized. It was decided therefore to adopt for the car equipment a type and dimension of car which would permit, if necessary, of through operation over connecting lines. It was also decided to adopt a system of electric distribution which was standard on connecting lines, namely, third-rail contact and direct-current at 600 volts for the propulsion current, and alternating-current transmission at 11,000 volts for conversion at sub-stations.

General Layout.—Current for the entire system will be generated at the large power house now nearly completed at Long Island City. This power house will eventually be one of the largest in the world, and is being entirely equipped with steam turbines. There are at present installed three Westinghouse-Parsons turbine units of 5,500-kw. capacity each, and the engine room provides facilities for three more such units. The station does not stand at the center of gravity of the electrified system at present, but it must be remembered that the Long Island electrification forms a part of the general scheme for the operation of the Pennsylvania R. R. terminal and the moving of trains in the North and East River tunnels. When all these improvements are in complete operation, and when the Western Division of the Long Island R. R. is entirely electrified, the Long Island City location will be in about the center of distribution.

The three-phase alternating current generated at the power house is carried in conduits through the built-up portion of Long Island City as far as the railroad yards. From here the cables are brought overhead and carried on a specially designed latticed steel-pole line. The construction of this line represents an advance over anything hitherto attempted in this direction. The poles are of strong construction and mounted on concrete foundations. Wherever the transmission lines cross telegraph or telephone wires, the latter are led underneath the high-tension wires, the very substantial character of the heavy electric cables precluding their breaking and falling across the telegraph wires. A further precaution is taken by having the poles placed closer together at such points.

This pole line follows the railroad tracks to Winfield, from which place it is led across country on a special right of way to Glendale Junction, where it again follows the railroad to the sub-station at Woodhaven Junction. At this point the lines branch off in the direction of the different sub-stations.

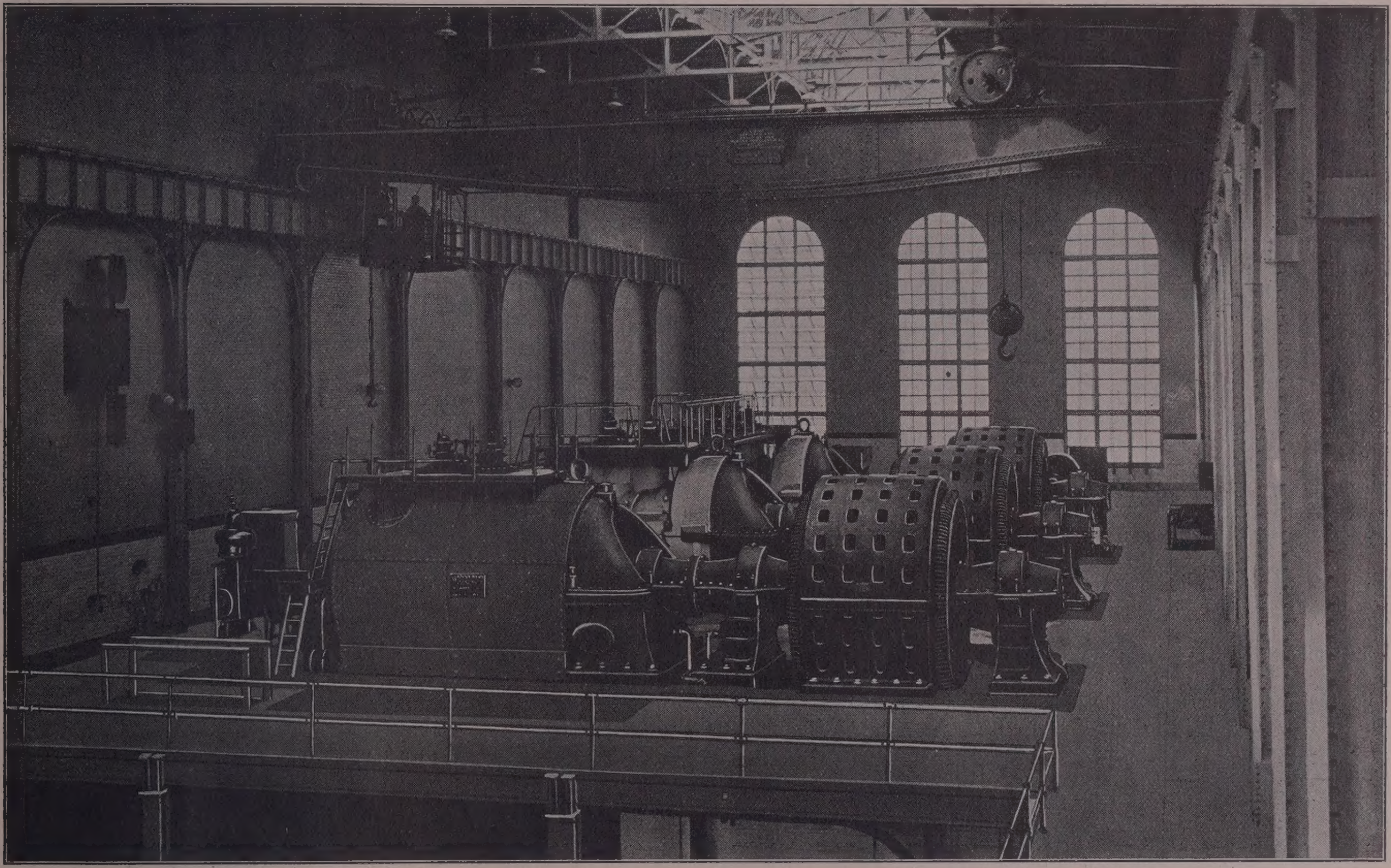
In a transmission line of this kind, where bare wires are used, there is always a certain amount of danger to be feared from the effects of lightning. This has been carefully guarded against in the present installation. Lightning arresters have been placed in all sub-stations and special arrester and cut-out houses have been erected at all places where the transmission wires are led from overhead and carried in underground or submarine conduits, and vice versa.

The sub-stations are five in number, and are located at the following places: No. 1, Grand and Atlantic Aves., Brooklyn; No. 2, East New York; No. 3, Woodhaven Junction; No. 4, Near Rockaway Junction; No. 5, Hammel. It will be noticed that as far as possible sub-stations have been located at junction points, such points being more practicable, as the heavy loads occur at them. Such locations also make it possible and convenient for the arrangement of transfer switches for the high-tension circuit.

Taking up now the equipment of the different sub-stations: The one at Woodhaven Junction is the largest of all, being provided with an initial equipment of three 1,500-kw. rotary converters and nine static transformers of 550-kw. capacity. Ultimately this station will be equipped with six 1,500-kw. rotary converters, with a corresponding increase in the number of static transformers.

The Grand Ave. sub-station is provided with an initial equipment of three 1,000-kw. rotary converters and nine static transformers of 375-kw. capacity. The ultimate capacity, however, will include four 1,500-kw. rotary converters, with a corresponding increase in transformer capacity.

It might be said here that all these sub-stations, which are now equipped with 1,000-kw. rotary converters, are provided with foundations of sufficient size to accommodate converters of 1,500-kw. capacity, the idea being that as soon as the present sub-stations reach their maximum capacity with 1,000-kw. converters, the sections of



General View of Turbines in Long Island Railroad Power Station.

railroad electrically equipped will have extended far enough to warrant the building of more sub-stations further out on Long Island. It will, therefore, be possible to move the 1,000-kw. converters from their present stations to the outlying ones and erect in their place converters of 1,500-kw. capacity.

The Rockaway Junction sub-station is provided at present with an initial equipment of two 1,000-kw. rotary converters and six static transformers of 375-kw. capacity. The ultimate equipment will include four 1,500-kw. rotary converters and the proper number of static transformers.

The East New York sub-station has an equipment of three 1,000-kw. rotary converters, with nine 375-kw. transformers, while the ultimate equipment will consist of four 1,500-kw. rotary converters and the corresponding number of transformers.

The sub-station at Hammel is equipped with two 1,000-kw. rotary converters and six 375-kw. transformers. Ultimately, however, it will contain six 1,500-kw. rotary converters, with a corresponding increase in transformer capacity. In addition to the above, this sub-station is provided with a storage battery of 2,000-kw.-hours capacity, making it the largest storage battery in the world in use for electric railway work. Its installation was deemed expedient owing to the fact that the Hammel sub-station is the farthest from the power station and the transmission line is exposed to an unusual extent, being carried over Jamaica Bay for four miles. Furthermore, the load at Hammel is very light during the winter and the very large battery capacity makes it practicable to shut down the rotary equipment for much of the time during the winter months.

Before leaving the subject of sub-stations, it might be well to mention that all of them are provided, on emergency, with the means of augmenting their capacity to the extent of 1,000 kw. through the use of portable sub-stations. These consist of steel cars, each carrying a 1,000-kw. rotary converter and three static transformers. Two such portable sub-stations have been built. They were designed primarily not only to reinforce the permanent sub-stations, but to maintain the potential at any points where traction might temporarily be very heavy. Such conditions would be met at the different race tracks. While the use of portable sub-stations is not new, yet it is interesting to know that they are being used on a larger scale in this installation than has ever before been attempted. One reason for their extensive use is found in the fact that no feeders are used for supplying the third rail, the high conductivity of these rails permitting of the dispensing of feeders for all ordinary conditions of traffic.

Third Rail.—Direct current at a potential of 600 volts is led directly to the third rail from the different sub-stations, and is carried in this way to considerable distances, great care being taken with this third-rail installation to guarantee the safety of pedestrians, and no expense has been spared to attain this result.

The rail is laid at the standard distance from the track rail adopted by this road, the Pennsylvania R. R. and the Interborough Rapid Transit Co., namely, 27 in. from the gauge line of the track to the center line of the third rail, and with top of rail 3½ in. above the top of the track rail. Placing the third rail in this position will allow interchange between these railroads and will permit of proper clearances for steam equipment, especially the steel hopper cars now in general use.

The rail is laid on sleepers, which extend at intervals beyond the line of track, and is supported by insulators made of vitrified clay. It is covered throughout its entire length by a wooden sheathing, held in place in the following manner: Brackets of steel attached to the rail are firmly bolted to wooden uprights outside the rail, and to these, by separate bolts, are attached a second set of strong brackets supporting a plank 2 in. thick at a height of about 4 in. above the rail. Wherever the rail is led in front of stations, a special side sheathing is attached to both sides, to make it practically impossible for pedestrians to come in contact with it. Another feature in connection with the protection of passengers at stations is the fact that a running board, similar to the one covering the third rail, is led along the outside edge of the platform to prevent passengers from coming in contact with the collector shoes of the motor cars.

At either side of a grade crossing, the third rail terminates in a broad sloping shoe, similar to that at switches and crossing in the subway or on the Manhattan Elevated. This is considerably within the line of protecting fences which enclose the entire right of way, and a heavy insulated wire cable connects it with the third rail, similarly situated beyond the break, the cable passing underground in a concrete duct situated at a depth not likely to permit interference by crossing repairs.

The total mileage of third-rail installation reduced to single-track basis is 97½. This is divided up in the following manner: Miles of main line equipped, 42; main line single-track mileage equipped, 90; sidings, 7.5; making a total of 97½ miles for the system.

Trains.—The trains are made up of steel motor cars, of which 130 have already been equipped and trailers in the ratio of three to two—that is, a five-car train will consist of three motor cars and two trail cars, the motor cars being 1, 3 and 5. An eight-car train, however, will consist of five motor cars and three trail cars, the motor cars being 1, 3, 5, 6 and 8, or else Nos. 1, 3, 4, 6 and 8. By this arrangement it is possible to make up three-car trains, consisting of two motor cars with a trail car between them, by simply taking off two cars from either end of a five-car train.

All the cars are equipped with the Westinghouse pneumatic multiple-unit system of control, and each motor car has two propelling motors of 200-h.p. each, both of which are carried on the same truck. Both cars and trucks were designed by George Gibbs, chief engineer of electric traction for the Pennsylvania, New York & Long Island R. R. and for the Long Island R. R., and were built by the American Car & Foundry Co. and the Baldwin Locomotive Works, the cars being constructed by the former company and the trucks by the latter.

These cars are quite similar in appearance to the steel cars in use by the New York Subway, which were also designed by Mr. Gibbs, being constructed throughout of steel and finished in aluminum. The problem of their design has been considerably simplified through the experience already gained with the subway cars. The requirements of the Long Island R. R., however, necessitated the embodying of a good many special features in order to conform to the requirements of the service. For instance, all the conditions and limitations which applied to the New York Subway, such as limited subway heights and clearances on curves, high speeds with frequent stops, maximum strength combined with smallest possible weight, etc., applied with equal force to the Long Island problem, since the Long Island cars were designed to interchange with the cars in the Manhattan Subway. An additional feature presented itself, however, in the fact that trains, after leaving the city limits, had to run on the ground and let passengers on or off at stations whose platforms did not come flush with the platforms of the cars. This necessitated the design of a special combination platform which should be the full width of the car when running within the city limits, but which would provide for a pair of steps to be used when running on the surface of the ground.

These cars are now receiving their equipment at the shops of the Long Island R. R. between Locust Ave. and Springfield, on the cut-off line to Valley Stream. The shops have a capacity for the equipment of about ten cars per week, which are received from the builders in an entirely completed condition as regards exterior and interior finish, but are bare of any electrical apparatus. After receiving their electrical equipment they are given many trial runs before being placed in active service. Each motor car weighs 83,000 lb., and is capable of maintaining a maximum speed of 55 m.p.h. and a schedule speed, including stops 1.6 miles apart, of 25 m.p.h.

A noticeable feature of their operation is the fact that, although attaining their maximum speed under very short headway, there is no jerk or jar experienced in the process, acceleration being accomplished very smoothly and evenly. The trains are brought to a stop in the same even manner, being equipped with specially designed air brakes controlled by the new Westinghouse graduated release triple valve. In this respect the equipment is a great improvement over any electric trains hitherto tried.

Inspection Sheds.—In order that the rolling stock of the road be kept to its full efficiency, large car-inspection sheds have been erected at Rockaway Park, Dunton and at the Morris Park shops, the one at Rockaway Park being 100 ft. x 30 ft. in size, the Dunton shed 200 ft. x 50 ft., and the one at Morris Park 200 ft. x 75 ft. These sheds are large enough to accommodate trains of eight cars, and are fitted with all necessary tools and appliances, the pits being fitted with compressed air pipes in order that pneumatic tools may be used under the cars.

Organization.—When it was decided three years ago to electrify the system, Westinghouse, Church, Kerr & Co. were engaged to act as engineers and constructors for the road, the entire work being under the direction of George Gibbs, who acted first as electrical engineer of the road and first vice-president of Westinghouse, Church, Kerr & Co. and afterward as chief engineer of electric traction for the road, the general features of the work being under the supervision of the electrical committee of the road, composed of various officials. The construction work was under the supervision of George B. Caldwell, who acted as superintendent of that department.

Work was begun on the various sections as follows: Power house, Sept. 15, 1903, the first engine being put in operation Jan. 6, 1905, and regular operation was commenced July 26, 1905. Work on the sub-stations was begun May 24, 1904, and completed July 7, 1905, the sub-stations being put into operation July 26, 1905. The transmission system was started Nov. 30, 1904, and finished May 27, 1905, while work on the third rail and the bonding of the tracks was begun October 6, 1904; finished Aug. 31, 1905, and put into operation July 26, 1905.

A Ten-Wheel Passenger Locomotive weighing 201,000 lb., probably the heaviest of the type ever built, has recently been put in service on the Lackawanna R. R. It has 26x22½-in. cylinders and 69-in. driving wheels, and with a boiler pressure of 215 lb. will have a maximum tractive effort of 35,100 lb., said to be the largest per unit of total weight ever attained. The total length of the driving wheel base is 14 ft. 4 in., and the weight on the drivers is 154,000 lb. This type of engine is required to haul long express trains over heavy grades at two different points.

The Power System of the Lackawanna R.R. in Luzerne County, Pa.

A Thesis submitted to the Faculty of the Worcester Polytechnic Institute for the Degree of Electrical Engineer by H. M. Warren, Electrical Engineer, Delaware, Lackawanna and Western Railroad Co.

To one not familiar with anthracite coal mining operations, the large amount of power necessary to produce the enormous output cannot be realized, and, until within the last few years, little or no attention has been given to the cost of power. The simplest and most wasteful of boilers, engines and pumps, as well as extremely long and poorly or entirely uncovered steam lines were used. Steam lines 3,000 ft. long are not uncommon, and the writer has run condensation tests on a 4-in. steam line 6,850 ft. in length. With these conditions, it is not difficult to obtain substantial savings by the introduction of electric power.

The questions of electric haulage and pumping were the first to be taken up by the mining companies, because the high cost of mule haulage was at once apparent, and the steam pumps inside the mines are very detrimental, due to the exhaust steam rotting the timbering and causing an extremely high temperature in their vicinity. It is also very difficult to maintain tight steam lines to these pumps. The success of the first electric installations was so marked that electric power is now being introduced for other purposes; among them being lighting, the operation of slope hoists in the mines, individual motor drives in the breakers, where the coal is prepared, and motors for various other purposes. In fact, it is now generally conceded that electricity is unquestionably the most suitable power for mine use. Compressed air was at one time considered preferable, and is still used in localities where the mines contain an excess of gas.

The Delaware, Lackawanna & Western Railroad Co.'s Coal Mining Department probably has more electrical apparatus in operation than all the other anthracite mines combined. The writer's experience during the past five years has shown that the amount of electric power required at the various mines is constantly increasing, and, with this condition, the use of a central generating plant, transmitting power to sub-stations, has been considered the most economical system to use.

A 2,000-kw., 2,300-volt, three-phase generating station was installed about two years ago at Scranton, and is now supplying power to five sub-stations. At the present time a second station in our Nanticoke district is under construction. The preliminary estimates, plans and details of this plant, with its sub-stations and transmission lines are the subjects dealt with in this thesis.

Preliminary Estimates.—Preliminary estimates have been made to show the relative merits of isolated stations using generators driven by simple non-condensing slide valve engines, as compared with a central station using steam turbo-alternators, operating condensing at about 150 lb. steam pressure, 200° Fahr. superheat and 28-in. vacuum. Simple non-condensing engines were considered at the isolated stations, because the load at these points would be very variable when supplying power to electric mine locomotives, hoists, etc. Preliminary estimates were also made, based on a central station using compound non-condensing engines, but, in order not to introduce too many preliminary estimates in this thesis, it is deemed advisable to compare only the simple engine units with the turbo-alternator central station, as the latter was shown to be more economical than the compound non-condensing installation when the estimates were made for the Hampton Central Station at Scranton.

The maps shows the relative location of the power house and the collieries to which the power is to be supplied, with the transmission lines connecting them. The conditions upon which the estimates were based are as follows:

At the Bliss Colliery 200 kw. direct current is required; at the Auchincloss Colliery, 300 kw. direct current and at the Truesdale Colliery, which is a new operation, 1,100 kw. alternating current and 40 kw. direct current are required. The rated horse-power of the boiler plant required is taken less than the boiler horse-power supplied to the engines on the assumption that the boilers can be readily operated at 20 per cent. above their ratings. In the estimate of the kilowatt capacity of the central station, the amount necessary to be delivered to the sub-stations has been reduced 35 per cent., due to the fact that the loads are variable, and 65 per cent. has been taken as the load factor. In the isolated stations 85 per cent. has been taken as the combined efficiency of the generator and engine. The combined efficiency of the transmission line, transformers and rotary converters has been taken at 84 per cent. in connection with the sub-stations, whereas the combined efficiency of the transmission line and transformers for induction motors has been taken at 90 per cent.

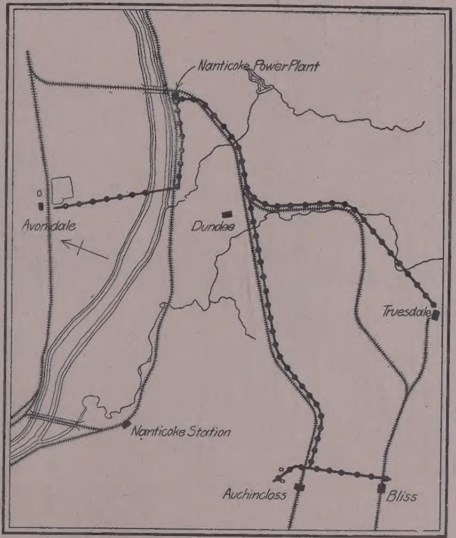


Diagram of Nanticoke Power Scheme.

The central station with the sub-stations to meet these requirements would cost approximately $10,000 more than isolated stations to meet the same conditions. The annual operating expenses, including interest and depreciation for the central station with sub-stations will be approximately $32,000 less than corresponding costs for isolated stations.

From these estimates, it is plain that the central station installation is the proper system to use, particularly in view of the fact that there will be a large increase in the amount of power required at the various mines.

Transmission Scheme.—A three-phase, 4,150-volt, 60-cycle system was adopted for the following reasons: First, because of the comparatively long transmission, three-phase system was considered the best; second, because of the use of this system at other plants operated by this company.

Sixty cycles was chosen because turbo-alternators of the size used were not built for lower frequency, and also for the sake of duplication with other plants. A voltage of 4,150 was selected, because as high a voltage as could be used consistently was desired, and as the high tension will be taken inside the mines, anything over 5,000 volts was considered liable to cause trouble from breakdowns, due to dampness. Standard 2,300-volt, delta-connected machines could also be furnished quickly, and these machines connected in Y are what will be used. This connection gives the 4,150 volts.

The four-wire system will also be used later on, permitting the use of standard 2,300-volt transformers for lighting purposes.

The fact that at some time in the future this plant may be inter-connected with the Hampton central station system is another reason for selecting 60-cycle, three-phase system.

Turbo-alternators will be used in preference to compound engine units, due to the lower first cost of the complete station, with equal, if not better, economy. The lower first cost is largely accounted for by the decrease in the cost of the building and foundations. Units of 500 kw. were selected, for the reason that they would be duplicates of those in use at the Hampton plant, and would also meet the load conditions. Three of these units will be installed at present, but provisions are being made for five. If varying sizes of units were used, the oil pressure required for the step bearing on the vertical type of turbine would vary, thereby requiring more than one oiling system.

Location of Power Plant.—The location of the power plant is shown on the map. This location was selected on account of its proximity to the railroad leading to the mines. This insures low cost of coal, and also provides an easy means of disposing of the ashes, as these will be used by the Transportation Depatment on their roadbed.

Water for boiler feed and condensing purposes will be taken from the river, and the elevation of the land at this point is sufficiently high to eliminate any danger of the power plant being flooded in the event of high water, which usually occurs annually in the spring. The low-water mark of the river is 512 ft. above sea level, and the highest water mark yet attained during the floods is 540 ft., or a rise of 28 ft. Electrically speaking, the plant is not centrally placed, but nearness to water and railroad really fixed the location.

Building.—The boiler and generating plant are set under one roof, with a brick dividing wall, with fireproof doors, separating same into two separate rooms. One end of the boiler plant is partitioned off by a brick wall, and its ground floor will be used as a pump room, containing boiler feed pumps and feed-water heater. Directly over these on the second floor will be located an office for the chief engineer, and the storeroom. The generator plant contains a gallery, supported on structural steel, which gallery carries exciters, switchboard and turbine steam valve floor stands. In about the center of this room a shaft is sunk for the condensing water.

Boiler Plant.—As already stated, three 500-kw. vertical Curtis turbines, and three 300-h.-p. Babcock & Wilcox boilers will be installed at present, with an ultimate capacity of five turbines and boilers. All of the auxiliary apparatus, except the two condensers and one 14-in. volute centrifugal circulating pump, are designed to meet the requirements of the complete station.

The boilers are designed to burn Culm or refuse ordinarily, and barley (which is the smallest prepared size of anthracite coal) when carrying extremely heavy loads. As this fuel cannot be burned at a very high rate of combustion, a large grate area is necessary.

Each boiler is rated at 300 h.-p., based on 10 sq. ft. of heating surface, not including the superheating surface, which is designed to superheat the steam 200° Fahr. above 365.5° Fahr., or a pressure of 150 lb. Including the superheating surface, the boiler will be rated at 313 h.-p.

The grate area is 91 sq. ft., and, when burning barley coal, an evaporation of 8½ lb. water from and at 212° Fahr. per pound of dry coal can be obtained. Hence, it is necessary to burn 1,352 lb. of dry coal per hour, or 14.85 lb. per square foot of grate surface per hour to develop the rated horse-power. As it is possible to burn 23 lb. per square foot per hour, it follows that approximately 500 h.-p. can be developed when forcing the boiler.

The Parsons system of forced draught will be used. This system consists essentially of a steam blower, using superheated steam for creating a forced draught in the ash pit; pinhole stationary grate bars, containing about 10 per cent. air space; a specially constructed bridge wall, allowing the admission of a mixture of air and superheated steam over the fire, and an automatic steam blower controller, to maintain a constant steam pressure.

As the guaranteed steam consumption of these blowers is not over 3 per cent., the efficiency is practically the same as an engine-driven fan equipment, and has the particular advantage of the elimination of clinker, due to the introduction of superheated steam under the grates. This clinker formation when burning culm is excessive when using natural or fan blast.

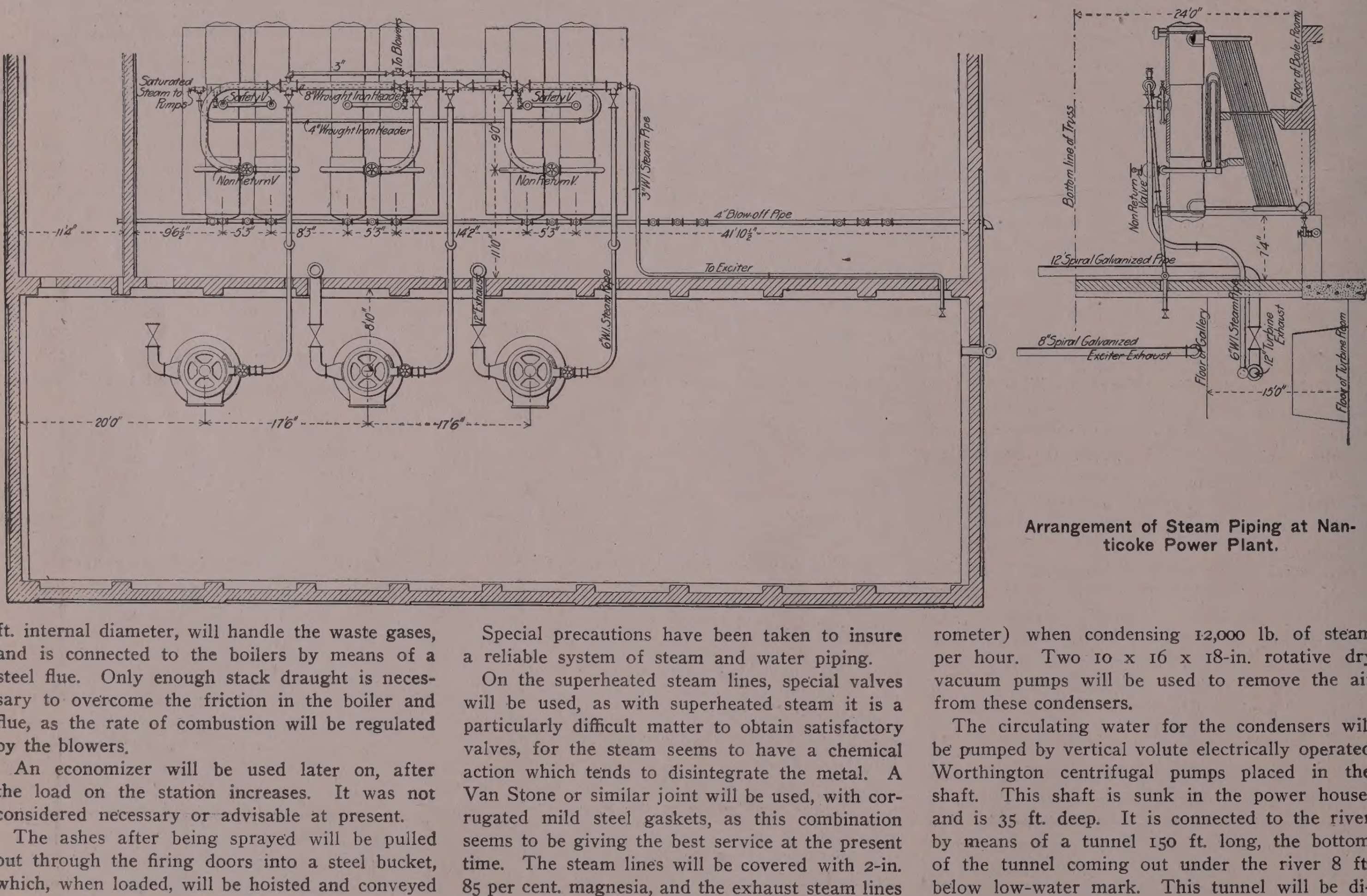
A brick Custodis stack, 75 ft. high and of 7 ft. internal diameter, will handle the waste gases, and is connected to the boilers by means of a steel flue. Only enough stack draught is necessary to overcome the friction in the boiler and flue, as the rate of combustion will be regulated by the blowers.

An economizer will be used later on, after the load on the station increases. It was not considered necessary or advisable at present.

The ashes after being sprayed will be pulled out through the firing doors into a steel bucket, which, when loaded, will be hoisted and conveyed by a telpherage system to a dumping ground or hopper, from which it may be loaded into railroad cars for use along the road. This system of removing the ashes will be operated electrically from a 125-volt direct-current exciter current.

The coal will be dumped from railroad cars into a depression between the rails, and from this point will be taken into the boiler house by a conveyor line, operated by a 20-h.-p. induction motor.

The water returned from the condenser hot well pumps will pass to an open type Cochrane feed water heater, and thence through a boiler feed pump to the boilers.



Arrangement of Steam Piping at Nanticoke Power Plant.

Two 10 x 6 x 12-in. duplex outside packed Knowles plunger pumps will be used, each of sufficient capacity to furnish feed water for the complete station. The make-up water will be pumped from the river, and can be taken either from the condenser circulating water connection, or be pumped by a separate vertical duplex steam pump, located in the water shaft, where the circulating pumps are placed. The piping arrangement is such that in case of necessity the vertical pump may discharge directly into the boilers, but, ordinarily, the make-up water will pass through the feed water heater. The boiler feed pumps can also pump cold water direct to the boilers.

The only exhaust steam ordinarily available for heating the water will be that from the boiler feed, oil and vacuum pumps. The exhaust from the first stage of one turbine is, however, connected to the heater, but can be used only when this turbine is operating non-condensing. The first-stage relief connections of the other turbines are piped direct to the atmosphere.

The feed water will be admitted to the boilers automatically by Vigilant feed water regulators, and the boiler feed pumps wil be controlled by a pump governor, thereby maintaining a constant pressure in the feed line.

Special precautions have been taken to insure a reliable system of steam and water piping.

On the superheated steam lines, special valves will be used, as with superheated steam it is a particularly difficult matter to obtain satisfactory valves, for the steam seems to have a chemical action which tends to disintegrate the metal. A Van Stone or similar joint will be used, with corrugated mild steel gaskets, as this combination seems to be giving the best service at the present time. The steam lines will be covered with 2-in. 85 per cent. magnesia, and the exhaust steam lines with 1-in. 85 per cent. magnesia.

Generating Plant.—The generating plant is shown in the illustrations. The foundations for the turbines will extend 5 ft. above the floor line, in order to give access to the step bearing. A gallery will be constructed in such a way as to give access to the generator part of the turbines, and also permit an easy inspection of the oiling system in connection with the top turbine bearing. The turbine throttle valve will be controlled from this point, the valve stem being extended up through the gallery floor, and connected to a hand wheel located on floor stand.

The switchboard, as well as the 75-kw. 125-volt direct-current horizontal Curtis turbine exciter, and an 80-kw. motor-generator set will be placed on this gallery. This motor generator will consist of one 80-kw. 125-volt direct-current generator, direct-connected to a 100-h.-p. induction motor, the arrangement of the switchboard being such that these two exciter units may be operated in multiple if so desired. The turbine exciter, however, will only be used in starting up the plant, and the exhaust steam from this is consequently piped direct to the atmosphere.

The turbines are of the two-stage type, operating at a speed of 1,800 r.p.m., and delivering three-phase current at 4,150 volts. The first stage is connected by means of a Davis relief valve direct to the atmosphere. This valve is automatic in its operation, and would only open when the pressure in the first stage exceeds 5 lb. When operating condensing this valve is closed.

Each turbine is connected to a separate Worthington surface condenser, which has 2,000 sq. ft. of condensing surface. The condensed steam is pumped from these condensers back to the feed-water heater by means of electrically operated centrifugal pumps. This is a particularly novel feature, inasmuch as these centrifugal pumps work against a 28-in. vacuum on the suction side. These condensers ars guaranteed to create a 28-in. vacuum (when referred to a 30-in. barometer) when condensing 12,000 lb. of steam per hour. Two 10 x 16 x 18-in. rotative dry vacuum pumps will be used to remove the air from these condensers.

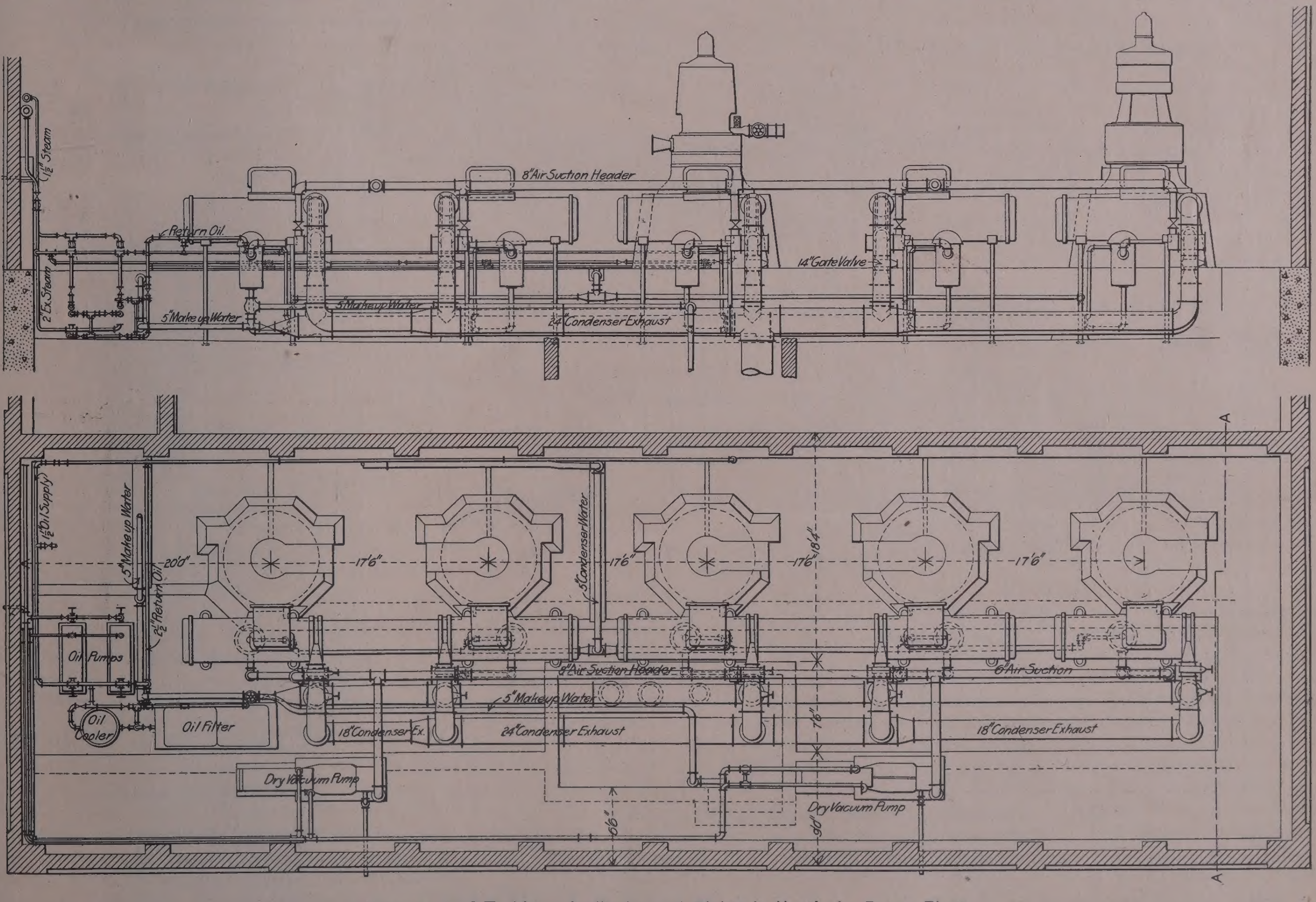
The circulating water for the condensers will be pumped by vertical volute electrically operated Worthington centrifugal pumps placed in the shaft. This shaft is sunk in the power house, and is 35 ft. deep. It is connected to the river by means of a tunnel 150 ft. long, the bottom of the tunnel coming out under the river 8 ft. below low-water mark. This tunnel will be divided into two parts, by means of a concrete partition, the water from the river coming in on one side, passing up through the pumps and condensers, thence through a vertical draft tube into the other compartment, and back to the river. This construction is necessary because the river rises at least 28 ft. when the floods occur in the spring.

By the use of a draft tube the amount of power necessary to pump this water when the river is low is reduced to a minimum. The motors for operating these pumps are placed at the top of the shaft on a level with the power house floor, so that they are above high-water mark, and will permit of the use of these pumps at all times.

Two pumps will be installed at present. One is an 8-in. pump, driven by a 30-h.p. vertical induction motor, which will be supplied with current from the high-tension lines through three 10-kw. transformers; the capacity of this pump is 1,800 gal. per minutes. The other is a 12-in. pump, capacity 3,600 gal. per minute, driven by a 60-h.-p. induction motor. This will be supplied with power from the high-tension lines by three 20-kw. transformers.

The oiling system will consist of two steam pumps, a dead weight accumulator, oil tank and purifier, and an oil cooler. The steam pumps will discharge the oil at about 300 lb. pressure into a main discharge pipe. From this it will be piped to each turbine. It then passes through a baffle plate, which reduces the pressure on the step bearing to 180 lb. A branch pipe is also taken to another baffle plate, which reduces the oil pressure for the middle and top bearings to about 5 lb. The oil from all three turbines then returns by gravity through a common header to an oil filter and tank, thence through an oil cooler to the pumps.

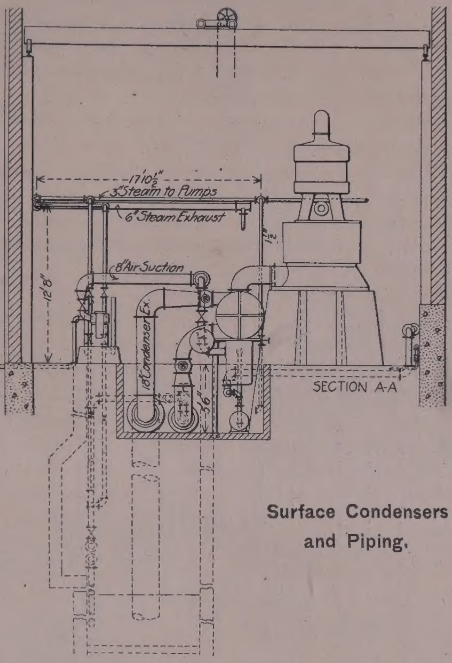
The dead weight accumulator is of sufficient size to give lubrication to the five turbines for five minutes, in case the pumps fail. This allows sufficient time to shut the turbines down before any damage is caused. The speed of the oil pumps is regulated by the height of the accumulator, and is so arranged that in case one pump fails and the accumulator drops 2 ft. below its normal position, it starts up the second pump. This arrangement has proved very satisfactory at the Hampton plant.



Arrangement of Turbines, Auxiliaries and Piping in Nanticoke Power Plant.

A marble switchboard, containing five 500-kw. generator panels, two exciter panels, one three-phase 1,500 kw. feeder panel, and one induction motor panel will be placed on the gallery. The wires from the switchboard to the turbines, motors, etc., will be carried in iron conduit, fastened to the under side of the gallery.

Sub-Stations.—The Auchincloss sub-station will contain one 300-kw. 550/275-volt, three-wire, six-phase rotary converter, with three 125-kw. transformers. This converter will be started from the alternating current end by means of a triple-pole double-throw switch, so connected with the transformers as to give a half voltage connection on starting. After the rotary has reached its speed, the switch will be thrown over to the full voltage running position. All the rotary converters are started in the same manner.



Surface Condensers and Piping.

Power will be supplied from this sub-station by a three-wire, 250-volt system to 15 motors, operating the Auchincloss breaker. Direct-current 500-volt power lines will be taken down the mine shaft, and supply power to two 13-ton locomotives, each locomotive being equipped with two 50-h.p. motors, (railway rating). Three 200-kw. transformers will be placed inside the mines, the high-tension circuit being carried directly to them. These will supply power to three form M General Electric Co.'s 200-h.-p. induction motors, operating hoists on slopes.

The Bliss sub-station will contain one 200-kw. 500-volt direct-connected rotary converter, which will operate in multiple with two 150-kw. engine-driven units. These will supply power to five electric locomotives, and two electric hoists if so desired. This rotary converter may be operated as an inverted converter, receiving power from the engine-driven units, and delivering alternating current back into the high-tension lines. This arrangement is used so that the central station may be shut down, it desired, on Sundays, when only a small amount of power is required at the other mines.

The high-tension line will also be taken direct to a drift, or opening in the side of the mountain, at the Bliss mines, for operating a 200-h.-p. induction motor hoist at this point. Three 125-kw. transformers will reduce the voltage to 440.

The Truesdale sub-station will contain at present one 200-kw. rotary converter, with three 75-kw. transformers. It is, however, arranged to accommodate an extra 300-kw. rotary converter, with its transformers. Three 250-kw. transformers, for supplying power to the induction motors operating breaker, will also be located in this building. One 13-ton electric locomotive will be installed at present, but others will follow very soon. A 150-h.-p. induction motor pumping equip-

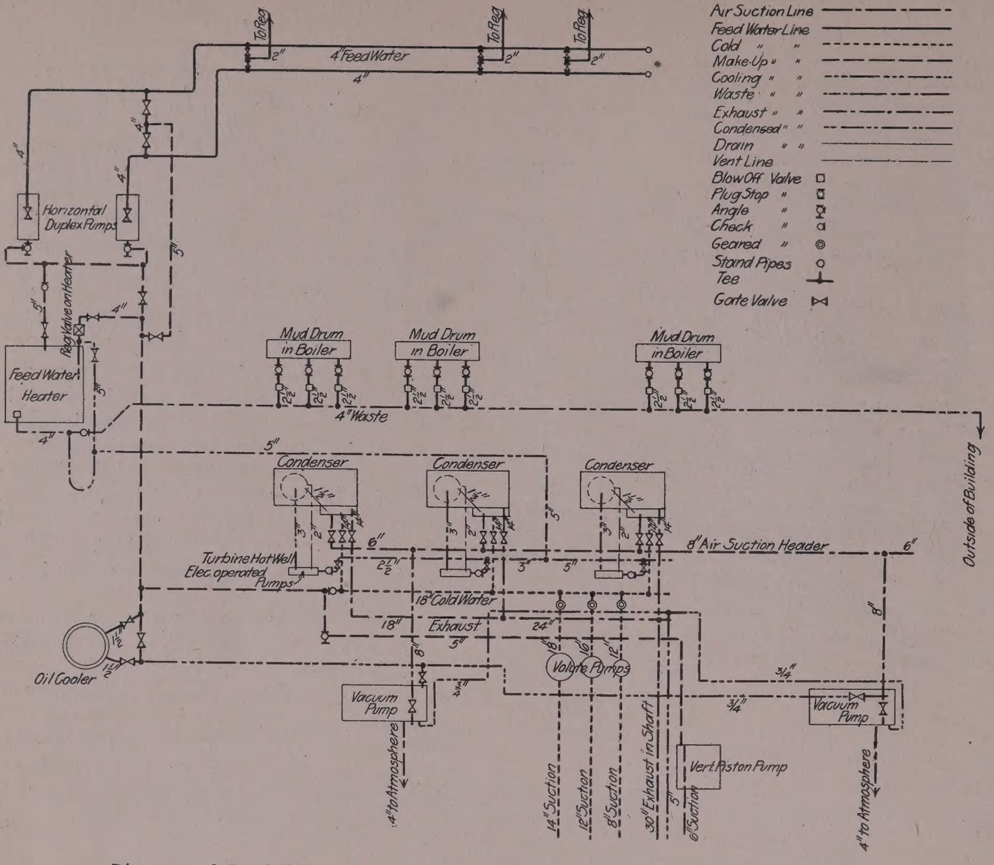


Diagram of Feed Water, Exhaust and Air Suction Lines, Nanticoke Power Plant.

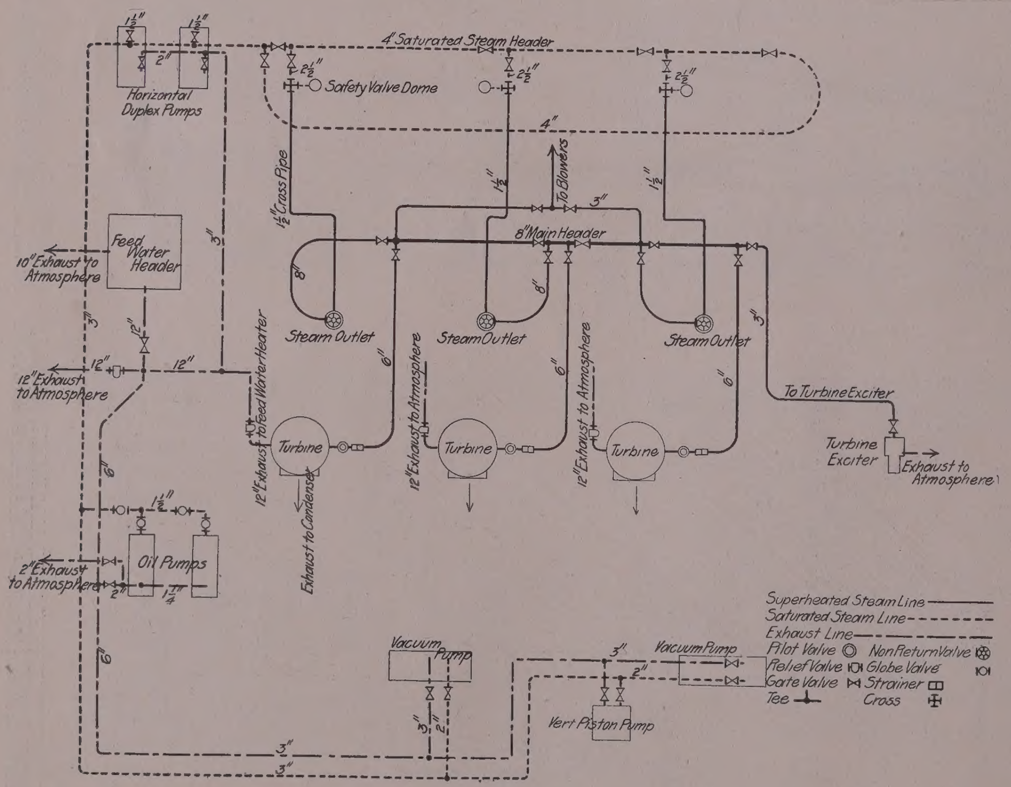


Diagram of Superheated, Saturated and Exhaust Steam Lines.

ment will be placed at the foot of the shaft, and will pump 700 gal. of water per minute against a 600-ft. head. One-half of the breaker will be equipped with motors at present; the remaining half will be equipped in about a year. There will then be 52 motors, with a total of 800 rated horse-power.

Transmission Line.—Only three wires of the transmission line are run at present, but when the load increases to warrant it, three additional wires will be run. There will then be two sets of three lines each; each set being arranged in the form of an equilateral triangle.

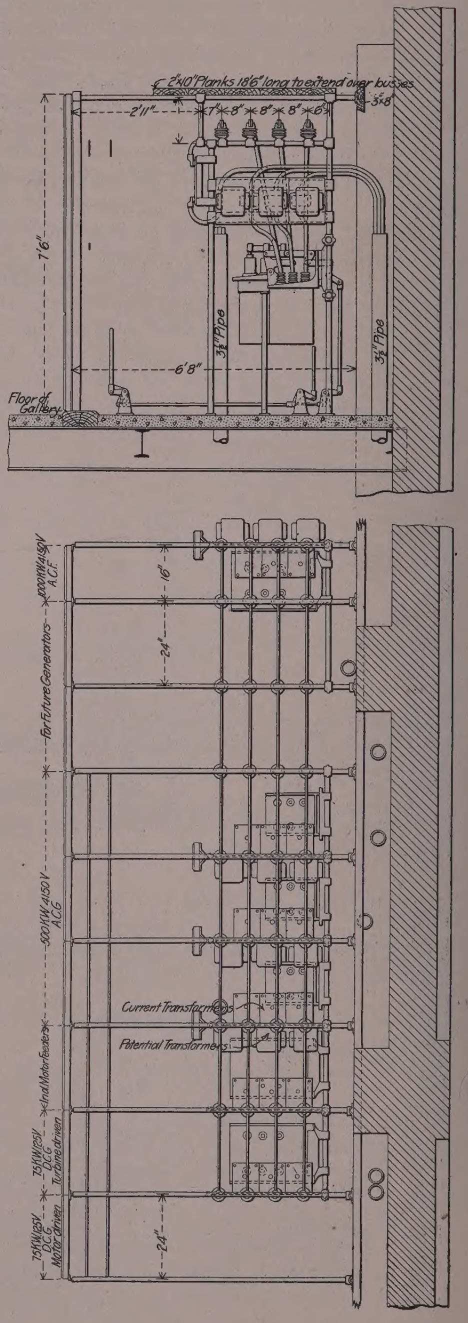
A telephone line connecting the power-house with the sub-stations is run on the same pole line, below the high-tension lines. Bare 0000 B. & S. copper wire is run from the power-house to the junction of the Auchincloss and Truesdale lines. From this point 0 bare copper wire is used.

All high-tension lines are supported on Locke porcelain insulators, guaranteed for 15,000 volts (breakdown test).

Suggestions Covering Combined Curb and Gutter.

By Albert Moyer.

The manufacture of cement or granolithic combined curb and gutter is practically that of forming what some describe as artificial stone in place at the point of use. The writer, however, strongly objects to the term "artificial stone." A stone formed by the use of Portland cement and various aggregates is not artificial stone, it is not an imitation of stone. It is stone artificially manufactured, containing all the elements and subject to all the laws of natural stone.



Switchboard Arrangement.

I would, therefore, ask the reader to keep constantly in mind the fact that the following specification is describing the manufacture of cement stone, monolithic in form. Each stone is subject to all the conditions surrounding the manufacture of what is popularly described as artificial stone, such as the careful selection of materials, thorough mixing of same, uniformly compacting by thorough tamping, allowances in joints between the stone thus formed for expansion and contraction, proper drainage foundation, uniformly tamped and preventing upheaval by frost, and careful seasoning and protection after the stone is in place.

The following suggestions for specifications are based on the best methods employed by several of the largest concrete contractors in this country. Practically the only experienced labor required is that of a good finisher. Special stress is laid on mixing and seasoning. The dimensions of combined curb and gutter largely depend upon the requirements. The usual dimensions are as follows: Top of curb, 4 to 6 in.; bottom of curb, 5 to 7 in.; face of curb, 7 in.; width of gutter, 16 to 20 in. This combined curb and gutter will be found as low in cost as the attainment of good results will permit.

Material.—Great care should be exercised in selecting materials, the following are necessary for the manufacture of "cement stone:"

Cement.—Only the most uniform, sound, strong, slow-setting Portland cement should be used, regardless of cost. An unsound cement is dangerous and expensive at any price, for not only is the cement risked, but the labor, other materials and the reputation of the party doing the work.

Broken Stone.—Broken stone for concrete must be a good hard stone that will not be affected by the weather, broken so that the largest piece will pass through a ring one inch in diameter, and must be free from dust, dirt or other foreign matter.

Gravel.—If gravel is used it must be washed river gravel, free from clay, loam, dust or other foreign matter, and of such sizes that the largest pebble will pass through a ring ¾-in. in diameter.

Sand.—The sand must be clean and sharp, preferably graded in size from fine to coarse grains, free from dust, loam or other foreign matter.

Screenings or Crusher Dust.—These are for wearing surface and must be of crushed quartz, granite or other hard, tough stone, free from mica or foreign matter and crushed so that the largest piece will pass through a sieve of ¼-in. meshes, the particles graded in size from fine to coarse; the crusher dust to contain not over 30 per cent. of fine dust.

Cinders or Broken Stone for Foundation Drainage.—These materials must be broken so that the largest piece will not exceed 3 in., and the smallest to be not less than 1 in. in diameter, free from dirt or other foreign matter. The cinders to be carefully selected furnace cinders. Blast furnace slag, broken as above, may also be used.

Water.—Fresh water must be used, free from either dirt or sewage.

Mixing Concrete.—The uniformity of the concrete makes expansion and contraction of all parts of the mass the same under the same conditions, thus lessening the liability of checking and cracking. To obtain a uniform concrete, thorough mixing is necessary. The best results are always obtained by using machinery, but if hand mixing is the only process available, the following method has given excellent results and is to be recommended:

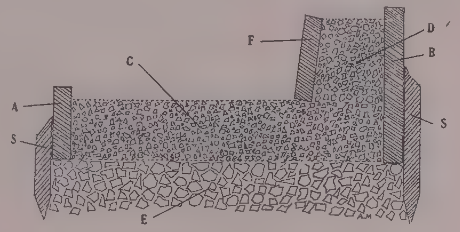
Provide two mixing platforms, one for the sand and cement and the other for the stone or gravel. Mix the sand and cement (dry) thoroughly and uniformly together, turning the mass over about three times with spades or shovels and raking thoroughly with a garden rake during the process of turning, until the mixture of sand and cement shows a uniform color throughout. Then spread the stone or gravel to a uniform depth of about 6 in. on the second platform, wet the stone or gravel thoroughly and then spread the dry mixture of sand and cement over the stone or gravel; finally turn the whole mass over with shovels about three times or until thoroughly incorporated. If the mixture is not sufficiently wet add a little water from time to time with a sprinkling pot during mixing. Add sufficient water so that the moisture will come to the surface when the mass is tamped. The concrete should be dumped in place, not dropped from a height, as this tends to separate the stone from the mortar. The concrete should not be mixed in larger quantities than is required for immediate use.

Retempering of cement mortar should never be permitted.

Drainage Foundation.—Excavate to a sufficient depth so as to get below the frost line, ram and tamp the ground thoroughly and evenly, fill in with clean cinders or broken stone to within 6 in. of top of established grade of the gutter. Tamp well and evenly, thoroughly wet the cinders or stone. As an additional precaution, side drains should be placed every 10 or 12 ft, leading to some point forming an outlet for water which may accumulate.

Wooden Forms.—Place in position forms to receive the concrete. These forms are held in place by stakes set by the engineer at points necessary to accurately designate the line and grade of proposed curb and gutter. (See diagram A. B and S). For forms use 1½ to 2-in rough planks. "A" 6 in. deep, "B" 13 in. deep, 'F" 6 to 7 in. deep, according to required height of curb above gutter. Form "F" is movable and is held in place by iron clamps bearing against outside of form "B" extending over top of curb and bearing against outside of form 'F"; this clamp is shaped like the letter C; one of the arms is fitted with a screw.

Concrete Base.—For the concrete base, between forms "A" and "B," spread 5 in. of concrete composed of one part Portland cement, two and one-half parts sand and five partas broken stone or gravel; mix thoroughly. Concrete should be medium wet, so that when tamped some water will come to the surface. Place in position form (F) and fill in with concrete of same mixture, tamp thoroughly and evenly to within one inch of top of curb; form (F) may be taken down immediately and moved to next position; form (B) will be found sufficient to hold concrete curb in place. Cut concrete curb and gutter entirely through, every six feet. A convenient and sure method is to use a piece of ¼-in. sheet iron the height and width of curb and gutter, as a division partition, fasten a handle on top, shape the sheet iron same form as concrete base of curb and gutter. See diagram "C" and "D." Place this sheet iron division every six feet between forms "A" and "B," tamp concrete all around on both sides of this sheet iron from; pull out same immediately after form "F" is removed, fill in cuts thus formed with dry sand, mark forms A and B opposite cuts, so as to accurately locate. After each batch of concrete is laid it shall be immediately covered with the top coat or wearing surface.



Mold Boards for Curb and Gutter.

A, 6 x 1½-in. plank; B, 13 x 1½-in. plank; C, concrete base; D, base of curb; E, drainage foundation; F, 7 x 1½-in. plank; S, stakes nailed to boards A and B.

Top Surface.—For the top coat or wearing surface, mix one part Portland cement to two parts screenings, crusher dust or sand. When sand is used, make proportion one part Portland cement to one and one-half parts sand. Sand does not make as good a wearing surface as screenings or crusher dust (crushed stone). Cover immediately concrete base of curb and gutter with one inch of this mortar mixed medium wet; slope the gutter to meet the requirements of drainage by increasing the thickness of the top coat on side nearest street. Work to an even surface with a straight edge laid parallel on the curb and shifted from form "B" to form "A." The upper face corner of curb and the angle between curb and gutter should be rounded with a radius of one to one and one-half inches. After getting a good surface, "float" with plasterer's "float" until a smooth, even surface is obtained; dust top evenly with one part Portland cement and one part granite dust, before surface water has been absorbed; immediately trowel; do not let too great an interval elapse between floating and troweling. Use a curved trowel for top corners of curb and angle between curb and gutter. After troweling finish with a soft brush (an ordinary hearth brush or whitewash brush will do). If top is too dry sprinkle with water. The brush will take out trowel marks and give an even texture and color to the finished work. Cut top coat directly over cuts made in concrete base, bevel the edges of the cuts with a "joiner."

Protection, Seasoning.—Immediately cover the curb and gutter with canvas, tar paper, or boards, raised a few inches so as not to come in contact with any part of the work; or, better still, after hard set, sprinkle work with sand to a thickness of ½-in. and wet thoroughly; protect from rays of the sun as above.

After work has been down 15 to 20 hours, wet thoroughly with a sprinkler. Keep covered for a week and constantly wet; do not let it dry for a moment at any time during the first week.

Do not put any water on the curb and gutter until it has set hard, usually after 15 or 20 hours, then it becomes very necessary to keep same wet thoroughly and continuously for as long a time an economy will permit. Cement stone is best when kept entirely under water for at least one month. It becomes stronger and harder the longer it is kept wet; the same law applies to cement curb and gutter as to cement stone.

Notes. Do not lay new concrete on old concrete.

Do not spread a top coat over an old concrete base.

Cut out roots of trees that may extend under concrete.

Do not use a base of one brand of cement and a top surface of another; the different quality of the cement, difference in time of setting or hardening, contraction, expansion, etc., often cause top to crack from base.

These outlines for specifications are published in the interest of good concrete and are merely a suggestion; the personal intelligence and experience of those in charge of the work are relied upon to cope with conditions which may arise and which cannot be successfully covered by an article of this kind. Therefore, the above specifications are not a guarantee of the work done under same. I trust, however, that they may be of use and assistance to better workmanship, furthering the interests of "cement stone" and high-grade Portland cement.

An Electric Traveling Crane with a 40-ft boom and two-rope bucket is used in the yard of the Syracuse Lighting Co. in handling coal. The peculiar shape of the yard made it advisable to use an annular, rather than a rectangular, pile. Accordingly a circular track of 8-ft. gauge and 80-ft. diameter has been fenced on both sides and provided with this crane, which takes its current from a pair of wires strung along the inner fence. The coal is taken up by the bucket from the place where the cars dump it, and is then carried by the crane to the place where it is to be stored, which may be inside the inner fence or outside the outer fence. The crane was built by the Brown Hoisting Machinery Co.

The Marble Hill Cut-Off and Port Morris Branch, New York Central Terminal Improvements.

The Marble Hill Cut-off and Port Morris Branch are two of the many improvements now being made in the New York terminal of the New York Central & Hudson River R. R. Co., and in order to explain their purpose it is desirable to review in a general way at this time the condition of affairs in the "Electric Zone" of this company. This zone is the territory on its main line, or Hudson Division, from Grand Central Station to Croton-on-Hudson, a distance of 34 miles, and on the Harlem Division to North White Plains, a distance of 24 miles, the most noteworthy feature of the work being the departure from the use of steam as a motive power and the substitution therefor of electricity.

Notwithstanding the fact that within very recent years extensive improvements and additions have been made in and around Grand Central Station, it has been realized for some time by the company that the existing facilities were rapidly becoming inadequate to the demands upon them, and that more room, especially in the yards, must be provided. A large amount of real estate in the territory immediately adjoining the present yard was purchased and the buildings on it, to the number of nearly 200 residences, stores, apartment houses, churches and hospitals, have been demolished, with few exceptions. Since August, 1903, the contractors have been engaged in the task of excavating for a sub-surface yard to be 35 ft. below the level of the present yard. The surface yard, not only over the present area but that of the newly acquired land, is being lowered to a depth of 15 to 20 ft. below its present level, the whole involving the removal of over 2,000,000 cu. yd. of material, largely rock, and in places honeycombed with gas, water and sewer pipes.

The sub-surface yard, which will cover about 15 acres, will contain 5.1 miles of tracks and connect by easy grades with the surface tracks at 53d St. All suburban trains will enter and depart from this station, utilizing a double-track loop under the main station. By means of a direct connection with the 42d St. station of the Rapid Transit Co.'s passengers may proceed on the same level to the trains of that system.

The area of the surface yard will be increased nearly 20 acres by the incorporation of the reclaimed land, which will provide for 6.2 miles of tracks. The combined area of upper and lower yards will be about 58 acres, with 22.6 miles of tracks, as contrasted with 23 acres and 11.3 miles of tracks now available.

The surface facilities will be used for the movement of the through trains. Upon the site of the present station will be constructed an entirely new depot and railroad office building, including a branch post-office and facilities for the express companies.

The main entrance will be on 42d St., with side entrance and exits on Lexington Ave. and Depew Place. The general scheme of architecture at this entrance will be three arches, each 33 ft. wide and 60 ft. high, as illustrated in the Current News Supplement of this journal on Dec. 31, 1904. Beyond the entrance will be the 90 x 300 ft. ticket office space. On the street level adjoining the ticket office on the right will be the outgoing baggage-room, the proximity of these two features being exceptionally convenient for the traveler. Separate entrances will be provided for the suburban passengers with ample facilities for easily passing from one level to the other by means of broad stairways. The suburban station will be provided with its own concourse, commodious waiting and retiring rooms, and other facilities for the comfort of the public. The arrangements contemplated for handling baggage are exceptionally complete, and will care for the heaviest movement without delay or congestion.

The frequent train service contemplated with the commencement of electrical operation renders it absolutely essential for the safety of the public and efficient movement of the traffic that all grade street crossings within the limits of the Electrical Zone be abolished. This will be accomplished at some points by means or overhead bridges; at others by carrying the streets under the elevated tracks. Such improvements will be made at High Bridge, Morris Heights, University Heights, Yonkers, Hastings, Irvington, Tarrytown, Ossining and other points on the Hudson Division; and at Woodlawn Junction, Mount Vernon, White Plains and other crossings on the Harlem Division; also at grade street crossings between Westchester Ave. and Long Island Sound upon the line of the Port Morris Branch. At many points new stations will be constructed, designed to meet the requirements of the heavy increase in suburban travel which has for several years been apparent and will undoubtedly be much greater in the future. At all stations the platforms will be raised to the level of the car floors, thereby greatly facilitating the movement of passengers. The number of tracks on the Hudson Division will be increased to four at all points; in many six, and in some eight. The Harlem Division, which already has four tracks to Woodlawn, will be similarly equipped from that point to North White Plains. These additional tracks provide throughout the Electrical Zone a local and an express track in each direction, thereby separating the local from the through service and facilitating the movement of both.

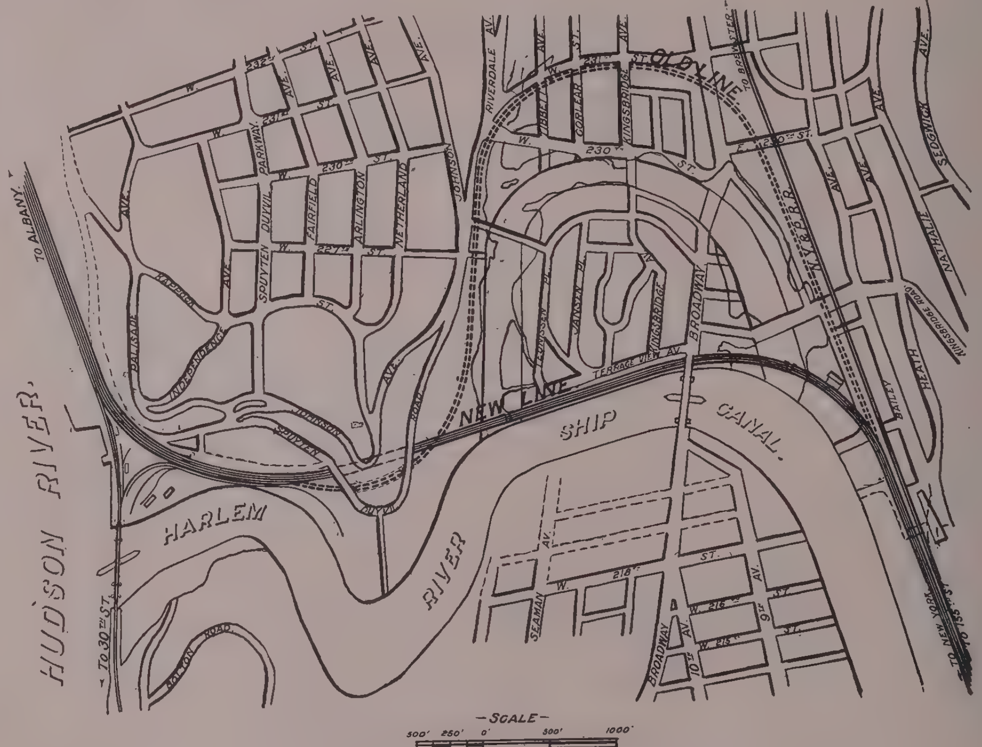


Diagram of Old and New Lines at Marble Hill Cut-off.

At Mott Haven, where two four-track routes will join a single four-track line, provision will be made for the elimination of all track grade crossings and a new overhead passenger station.

At Marble Hill, in the Borough of the Bronx, an important straightening of alignment is in progress. Beginning at a point near Kings Bridge station the tracks will be carried along the Harlem Ship Canal through a four-track single-arch rock tunnel 648 ft. long, the first of its kind that, so far as known, has been constructed; and thence to a connection with the existing line near Spuyten Duyvil.

This policy of rectification of alignment will also be followed at many other points along the Hudson Division, the tracks being at times carried further inland, and at others across indentations of the Hudson River. This will mean not only some decrease in distance and a consequent improvement in schedules, but it will also largely contribute to the comfort of the passengers, prolong the life of both track and equipment, and reduce the cost of maintenance.

At Croton-on-Hudson and North White Plains, the northern termini of the electrification zone, facilities will be provided for the change from steam to electric locomotives for the through trains and suitable shops erected for necessary repairs to the electrical equipment.

Two power houses will be provided, one located at the end of the Port Morris Branch on Long Island Sound, the other at Glenwood-on-Hudson, a suburb of Yonkers. Each will have an ultimate capacity of 45,000 h.p., or a total aggregate capacity of 90,000 h.p. A brief description of the Yonkers station will suffice for both, as they will be practically identical in construction. The foundations will be of concrete rising above the ground some 4 ft. in height forming a base for a superstructure of brick, trimmed with terra cotta. An account of the work on these foundations was printed in this journal on Dec. 10, 1904. The actual support of the floor systems, roof and stacks will be a steel skeleton frame independent of the brick enclosing walls. The purposes of the building will divide it into two main divisions; one for the boilers and coal pockets, and the other for the turbo-generators and other apparatus. These main divisions will be emphasized by the two steel skeleton monitors extending above the brick enclosing walls. The framework of windows will be of steel shapes made to harmonize in appearance with this skeleton framework of steel. The interior, by the use of enamel and pressed brick linings of the walls and by exposing the steel skeleton, will provide a simple treatment in which constructional parts of the building form the main decoration.

The main building will be 236 ft. long, 164 ft. wide and 100 ft. high. The twin masonry smoke-stacks, 290 ft. high, 24 ft. in diameter at the base and 18½ ft. at the top, with 17-ft. flues, will be landmarks for miles. The general aim has been to provide all possible architectural beauty consistent with utility.

Each 7,500 h.p. Curtis turbo-generator unit will be fed by four water-tube type boilers of 625 h.p., equipped with internal superheaters generating steam at 200 lb. pressure and superheated to 200°. The two stations will be cross-connected, so that in the event of accident either station may carry the entire load. Normally, however, the Yonkers station will furnish power for the Hudson Division while the Port Morris station will supply the Harlem Division. In each case the stations are so located as to be accessible by both rail and water, thus providing the cheapest possible transportation for fuel coal required.

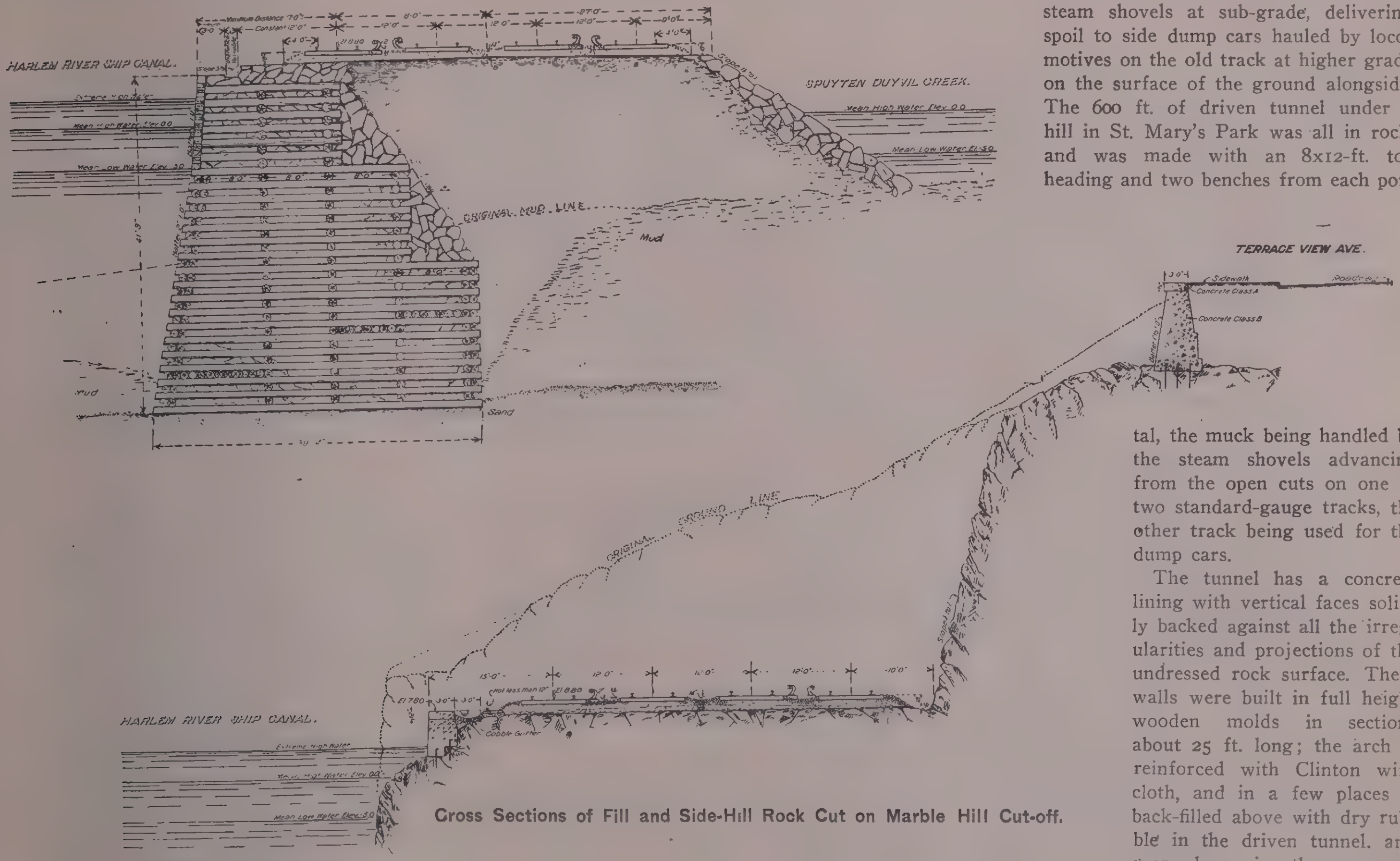
A feature of interest is the placing of the high-tension switches in a separate building, the switches being controlled from a board in the main station, thus making it possible in case of accident to cut the current off from the station itself. From the main stations a three-phase alternating current will be transmitted at 11,000 volts to eight sub-stations located at various points along the line and there transformed to 660 volts direct current. At the sub-stations provision has been made for the installation of storage batteries for the purpose of insuring uninterrupted service. Experience has shown that no electrically operated system can wholly eliminate the possibility of short circuiting of cables, accidents in power stations, etc. Generally these matters can be remedied within a comparatively short time and for the purpose of insurance against delay from such causes the battery installation will be sufficient to carry the full load. Actual operation will also frequently require the movement of a number of heavy trains over the line at one time, many of which might naturally be starting at the same instant, so that for the moment the demand upon the current would be excessive, and the batteries will also care for such violent fluctuations.

The third rail system will be used, except at special locations where overhead transmission will be employed. By means of a special device the contact shoe will be automatically lifted from the third rail just prior to its termination at such points while at the same time the overhead contact will be made, thus preserving the continuity of the current. The third rail will consist of a new type, illustrated in The Engineering Record of Sept. 2, 1905, and will be continuously protected from contact with human beings and from interruptions due to sleet and snow.

For the movement of the through trains powerful electric locomotives will be used, the first of which was completed in 1904 by the General Electric Co. and American Locomotive Co., of Schenectady. On Nov. 12, 1904, it had its first formal trial on a specially equipped track six miles in length, near Schenectady. In general design the electric locomotive is double-ended and symmetrical and can be operated with equal facility in either direction. It was described in this journal on Nov. 19, 1904. Its total weight is 97 tons, of which 67 tons is on the drivers, thereby giving a much greater effective tractive effort than the present Central Atlantic steam passenger locomotive weighing 150 tons. Its normal capacity is 2,200 h.p. with a maximum of 3,000 h.p., and its speed with a 600-ton train approximates 60 miles per hour. At the initial test a speed of 72 miles per hour was reached with a train weighing 170 tons exclusive of the locomotive, and 65 miles per hour with an eight-car train weighing 336 tons exclusive of the locomotive.

The suburban traffic will be cared for by the multiple unit system, thus avoiding the use of switching engines at terminals and doing away with the present necessity for flying switches with incoming trains. Steel cars will be used, each seating 64 persons, lighted and heated electrically and cooled and ventilated in the hot weather by electric fans.

With a daily movement in and out of Grand Central Station now averaging 640 trains, carrying 45,000 passengers and constantly increasing, and which movement, owing to the peculiar geographical characteristics of New York City, is, during the busiest hours almost wholly in one direction, the complex nature of the problems to be solved is at once apparent, especially when it is considered that all of these important improvements, involving radical changes in tracks and structures, must necesarily be made in conjunction with the safe and regular operation of the passenger traffic of two of the principal railroad systems of the world.



Cross Sections of Fill and Side-Hill Rock Cut on Marble Hill Cut-off.

Port Morris Branch.—The Port Morris Branch originally consisted of a single track surface line about 1¼ miles long from the Melrose station of the Harlem Division to the Harlem River. It has been replaced at a cost of about $500,000 by a double track depressed line in tunnel and open cut which has materially reduced the length and eliminated considerable curvature and all grade crossings. About 600 ft. of the tunnel was built in open cut with a maximum depth of 26 ft., with sides nearly vertical, and in most cases not sheeted. The excavation was made with air-driven rock drills and two Marion No. 20 steam shovels at sub-grade, delivering spoil to side dump cars hauled by locomotives on the old track at higher grade on the surface of the ground alongside. The 600 ft. of driven tunnel under a hill in St. Mary's Park was all in rock, and was made with an 8x12-ft. top heading and two benches from each portal, the muck being handled by the steam shovels advancing from the open cuts on one of two standard-gauge tracks, the other track being used for the dump cars.

The tunnel has a concrete lining with vertical faces solidly backed against all the irregularities and projections of the undressed rock surface. These walls were built in full height wooden molds in sections about 25 ft. long; the arch is reinforced with Clinton wire cloth, and in a few places is back-filled above with dry rubble in the driven tunnel. and everywhere in the open-cut section with selected earth, well rammed and watered. The arch center ribs, 30 in. apart, were made with triple-thickness scarf boards, braced by A-frames and supported at the center and on sills set against the faces of the side walls at the skewback level. They were covered with 16-ft. lagging, which, in the driven tunnel, was built up from the skewbacks in successive courses, both sides simultaneously, as the concrete was packed in from a platform, where it was delivered on an elevated narrow-gauge service track at skewback level.

In the open-cut sections the lagging was all nailed on to form a complete intrados, and the surface was divided into sections by transverse vertical bulkheads enclosing a portion of the arch, which was completed the same day that concreting on it was commenced. For this work the concrete was delivered in buckets by derricks from the cars on the track on the bank alongside. Both arch and side walls were waterproofed by the Sicilian Asphalt Co.

The retaining walls of the open-cut section were like the side walls of the tunnel, except that they were battered on the rear face, which was made in wooden molds and had a maximum height of 20 ft. They were made with the face molds braced to the center of the cut. The coping was made separate from the body of the wall and anchored to it with vertical bolts. The open cut is crossed by deck plate-girder street bridges, many of them skewed. At these points the continuous retaining walls are simply built higher and thicker and serve as abutments supporting the ends of the girders. The exposed surface of the concrete was all rubbed down smooth with stone floats before it was set very hard, and presents an unusually attractive appearance, being of uniform color and texture, and where the tracks are curved the long lines and rounded surfaces are especially symmetrical. The tunnel portals are coursed to represent ashlar ring stones, and the white surface and elliptical curves of the skewed section show to great advantage.

All the concrete on this branch was made 1:3:5 and 1:3:6 with Portland cement and broken stone and Cow Bay gravel. The concrete was all mixed at a central plant, where the stone was also crushed, screened, elevated and stored in a tower, from which the aggregate was handled by gravity, and the concrete was delivered from a Smith mixing machine to steel buckets on cars which distributed it as required along the line of the work. The principal quantities were about 110,000 cu. yd. of excavation and 25,000 yd. of concrete.

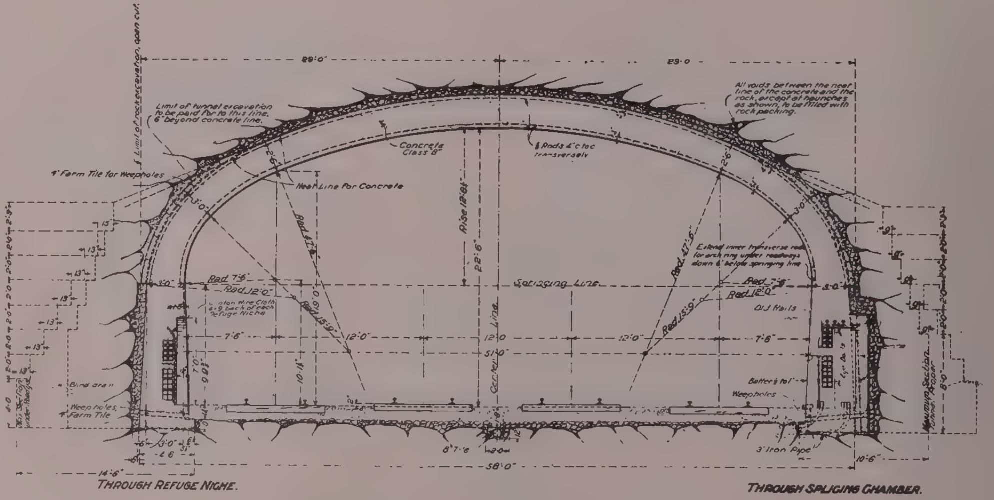
The electric mains from the Port Morris power house are carried through cuts and tunnels in single-tube terra cotta conduits. The conduits from the power house to the railroad were laid in a trench on a concrete foundation. A single row of piles was driven in the trench and the concrete filled around their heads. After it had set the terra cotta sections were laid up on it with cement mortar, and with their joints wrapped with burlap soaked in neat cement grout.

Marble Hill Cut-off.—The Marble Hill Cut-off, near Kings Bridge Station, is an interesting improvement of a 10,845-ft. section of the old double-track line which is replaced by a new line 6,910 ft. long, thus saving 3,945 ft., eliminating seven grade crossings, a large amount of curvature and some grade, providing two additional tracks, and saving 2½ minutes in the schedule time of passenger trains. The old line followed around a U-shape bend of the Spuyten Duyvil Creek, while the new line cuts across the open end of the U, crosses the creek twice on plate-girder bridges, is terraced out of the face of the hill, and passes under its summit in a four-track tunnel 648 ft. long, almost directly underneath the old high-grade alignment. At the east end the tracks pass under the Broadway bridge over the Ship Canal, and have necessitated the removal of its old abutment and the construction of a new one and a longer approach span to clear them. The embankments across Spuyten Duyvil Creek are protected by rip-rap and pavement, and the canal bank is faced with about 700 ft. of timber cribbing, filled with stone and sunk on a dredged sand bottom at a depth of about 28 ft. low water. The cribs are 39 ft. 4 in. wide at the base, and 41 ft. 3 in. high. They are made of round logs, except that above low water level they are faced with a solid course of squared timber, and are 18 ft. wide. They are backed with broken stone, against which the back-fill is packed, making the four-track embankment.

The side-hill tracks are about 15 ft. above mean low water, and are laid on a terrace about 61 ft. wide, part of which is on a tangent and the rest curved to a long radius. The shore side of the cut is sloped about ¼:1, and as the dip of the rock is down, away from the tracks, it does not require protection. Excavation was made simultaneously from both ends of the cut in transverse faces with irregular benches, sometimes scarcely defined, and resembling a general incline rather than distinct levels.

Service tracks were brought along in the cut from both ends, at sub-grade, and the rock was loaded by stiff-leg derricks on standard-gauge flat cars, and part of it was used for filling the adjacent cribs and embankment. At first care was taken to arrange and protect the blasts and direct the holes so that the rock should not be blown into the canal, but later on it was thought unimportant to maintain these precautions, and the contractor allowed a considerable amount of rock to fall into the canal, whence it had subsequently to be dredged. The rock excavation in this cut amounted to about 80,000 cu. yd. The ballast is retained on the river side by a concrete curb wall about 5 ft. high, with offset base anchored by dowels.

Other Track Work.—About $5,000,000 will be expended on the Harlem Division for building two new tracks about 12½ miles long from Woodlawn to North White Plains to complete the four-track system, for the elimination of all grade crossings, for an extensive detour from the present line at Mount Vernon and a handsome new depot there, a loop terminal and a large depot at North White Plains, and a detour from the present tracks at White Plains. In order to permit the installation of electric service on trains entering the New York terminal before the whole line to North White Plains is electrified, a temporary terminal will be established at Wakefield. There are also many minor improvements, hardly necessary to mention at length.


Limit of rock excavation, open cut.
29'0"
29'0"
Limit of tunnel excavation to be paid for to this line, 6" beyond concrete line.
All voids between the neat line of the concrete and the rock, except at haunches as shown, to be filled with rock packing.
Concrete Class "B"
Rods 4" c to c transversely
4" Farm Tile for Weepholes
Neat Line for Concrete
Rise 12'8½"
22'6"
Red. 47'6"
Extend inner transverse rods for arching under roadways down 6" below springing line
Red. 7'6"
Red. 12'0"
Springing Line
Red. 15'9"
Old Rails
12'0"
7'6"
51'0"
Center Line
Bind drain
Weep holes
4" Farm Tile
Batter ½ to 1'
Weepholes
6'7"
3" Iron Pipe
14'6"
58'0"
10'6"
THROUGH REFUGE NICHE.
THROUGH SPLICING CHAMBER.

Cross-Section of Four-Track Tunnel, Marble Hill Cut-off.

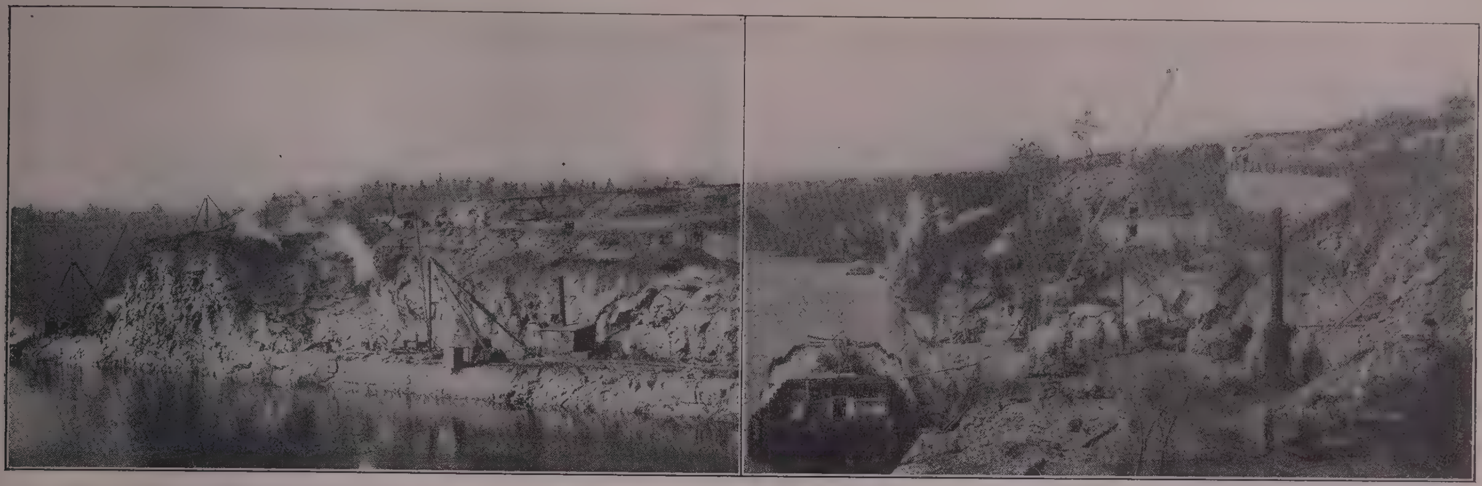
On the Hudson Division the improvements, outside of the Marble Hill Cut-off, include a new depot, yard and shops at Croton; a temporary terminal to allow electrical service to begin before the permanent improvements are completed, new stations and sub-stations at several points, the widening of the present Ossining tunnel from two to four tracks, and the addition of tracks which will give four tracks everywhere, six at many places, and occasionally eight.

The principal quantities in the track construction between Mott Haven and Croton include about 500,000 cu. yd. of excavation, chiefly rock, over 200,000 yd. of concrete masonry, 1,500,000 yd. of filling, and 1,000,000 cu. ft. of crib protection. At Mott Haven a new track is being laid each side of the original two-track line in a rock cut 800 ft. long and 15 ft. wide on each side of the original excavation. The average depth of the cut is about 25 ft. and the maximum depth is about 40 ft. The excavation is made with a face at right angles to the tracks, and is worked with small benches. Owing to the very frequent passage of trains great care is exercised in blasting; shallow holes are made close together and loaded with light charges of dynamite, and the blasts are protected with rope mats and chained logs. The spoil is handled by a 400-ft. cableway in each cut, which loads it on cars under the cableway on sidings carried from the main track between the cableway towers.

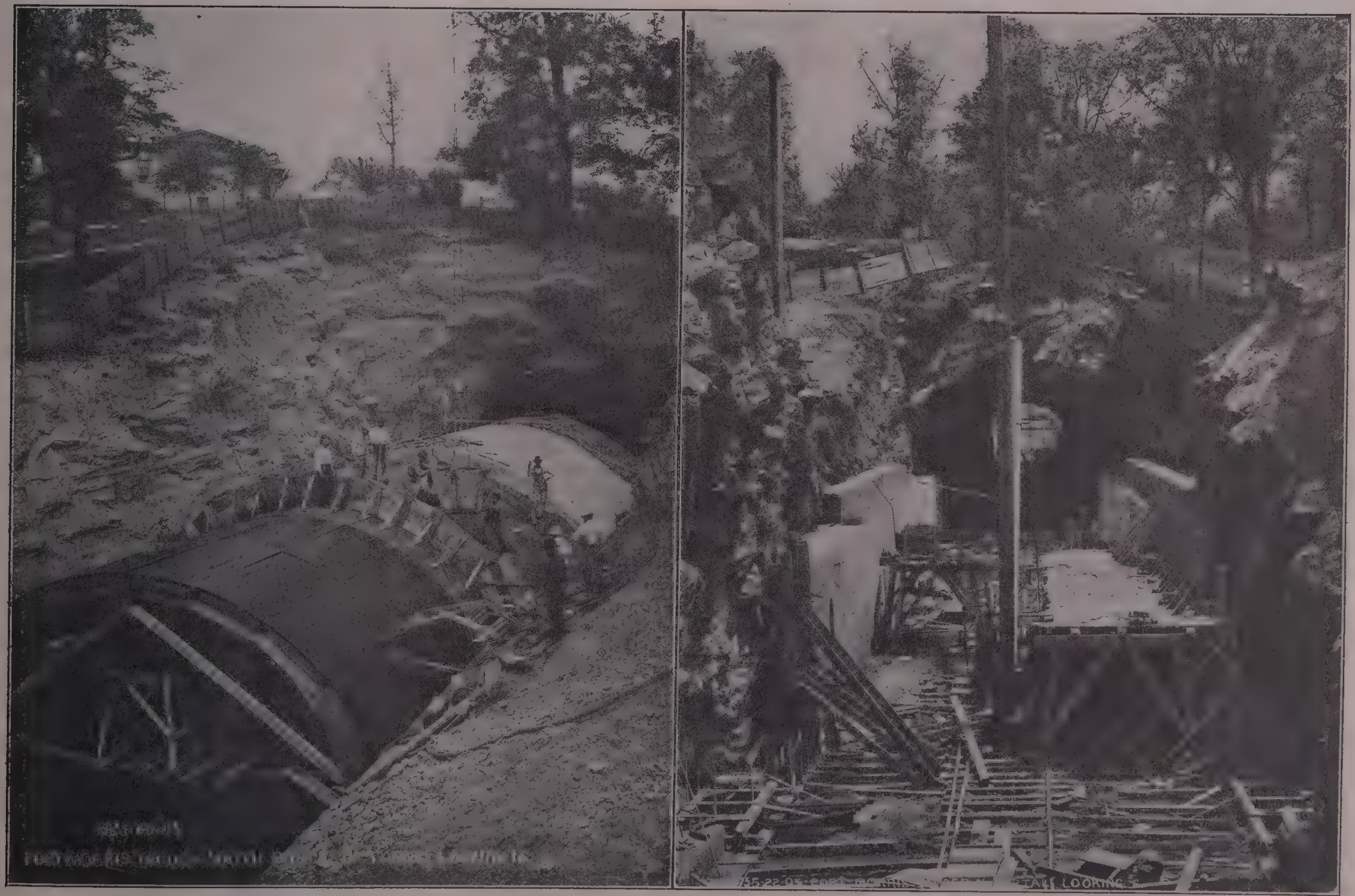
At other points on the line the new tracks are laid in cuts on either side of the old tracks, and often involve the removal of existing retaining walls and the construction of new and higher ones; but in most cases above Kings Bridge the new tracks are laid on new land made by filling in the river side of the embankment, which is to a large extent on the water's edge. The alignment of the track is being greatly improved by the elimination of much curvature, but the grade remains substantially as before. A large amount of concrete is required for bridge piers, abutments, foundations underpinning old buildings, and in some cases for protecting the vertical or inclined faces of rock cuts, where it is anchored to the rock with wedge bolts.

At Kings Bridge there are two girder bridges over the Spuyten Duyvil Creek, which have abutments and wing walls on pile foundations, built with open cofferdams made with a single row of 3-in. square-edge sheet piles, with their joints above low-water level covered by 4x1-in. inside battens. The lower part of the concrete was deposited under water by a tremie suspended by a hand tackle from a light traveling gallows frame, moved back and forth by hand. Considerable laitance formed over night on the surface of the submerged concrete, and great pains were taken to remove it by divers or with long-handle wire brooms before commencing work in the morning, so as to secure a clean, fresh surface for the next layer of concrete.

At the Kings Bridge station the 150-ft. platform will be supported at the outer edge on a curb wall containing about 700 yd. of concrete, built in place on the very irregular rock bank of the Ship Canal. The coping is uniformly 3 ft. wide, and the maximum dimensions of the wall are 13 ft. in height and 9 ft. in width. The cross-section is very irregular to conform to the jagged surface of the rock work which it covers, filling many cavities and surrounding projections, and often presenting a triangular outline. The base of the wall is often above low-water level, and never more than 2 ft. below it, so that it was possible to lay all the concrete without difficulty in molds, without providing for the exclusion of the water. The molds consisted of a single front wall, made of horizontal boards nailed to vertical strips anchored to the rock with wires permanently enclosed by the concrete. Where the lower part of the mold was submerged one horizontal edge of a longitudinal strip of canvass was nailed to it just above low-water level. The width of the canvas was a little greater than the distance from low-water level to the bottom of the mold; the canvas was at first placed horizontally across the interior of the mold and its free edge secured temporarily to the rock face or suspended by ropes from the surface. Concrete was placed on it, and as the shore edge of the canvas descended the concrete was deposited in the bottom of the mold without being washed by the water. The concrete was mixed in Ransome machines, and, like all that for the rest of the work, was made chiefly in the proportion of 1:3:6, Atlas and Lehigh cement being generally used.



Two Views Showing Character of Side-Hill Rock Excavation on Marble Hill Cut-off.



Views Showing Method of Constructing Walls and Arch on Port Morris Branch.

These improvements, the approximate cost of which is estimated at $60,000,000, have been designed and are being executed under the direction of Mr. W. J. Wilgus, vice-president of the New York Central & Hudson River R. R. Mr. W. H. Knowlton is principal assistant engineer, and Mr. A. B. Corthell terminal engineer. Mr. E. B. Katte is the electrical engineer of the company and secretary of the technical commission which has prepared the general scheme of electrification. Messrs. Lawrence and Coon are the resident engineers in immediate charge of the work on the Hudson and Harlem divisions, respectively. The Port Morris Branch work has been executed by the United Engineering & Contracting Co., the Marble Hill Cut-off by D. D. Streeter and the 42d St. yard improvements are being carried out by the O'Rourke Engineering Construction Co.

The Hydraulic Plant of the Chattanooga & Tennessee River Power Co.

By the award on Oct. 19 of a contract of about $1,000,000 for excavation, embankments and concrete work, the construction is assured of a plant for utilizing 56,000 h.-p. of the energy of the Tennessee River in the gorge of the Cumberland mountains at Hales Bar, Tenn., 33 miles below Chattanooga. The works will cross the river at a point where the rocky sides of the valley converge to a width of about 2,000 ft., at a height of 40 ft. above low water level, and the dam will create a pool 36 miles long, with a depth of from 20 to 40 ft. at low water for most of the distance.

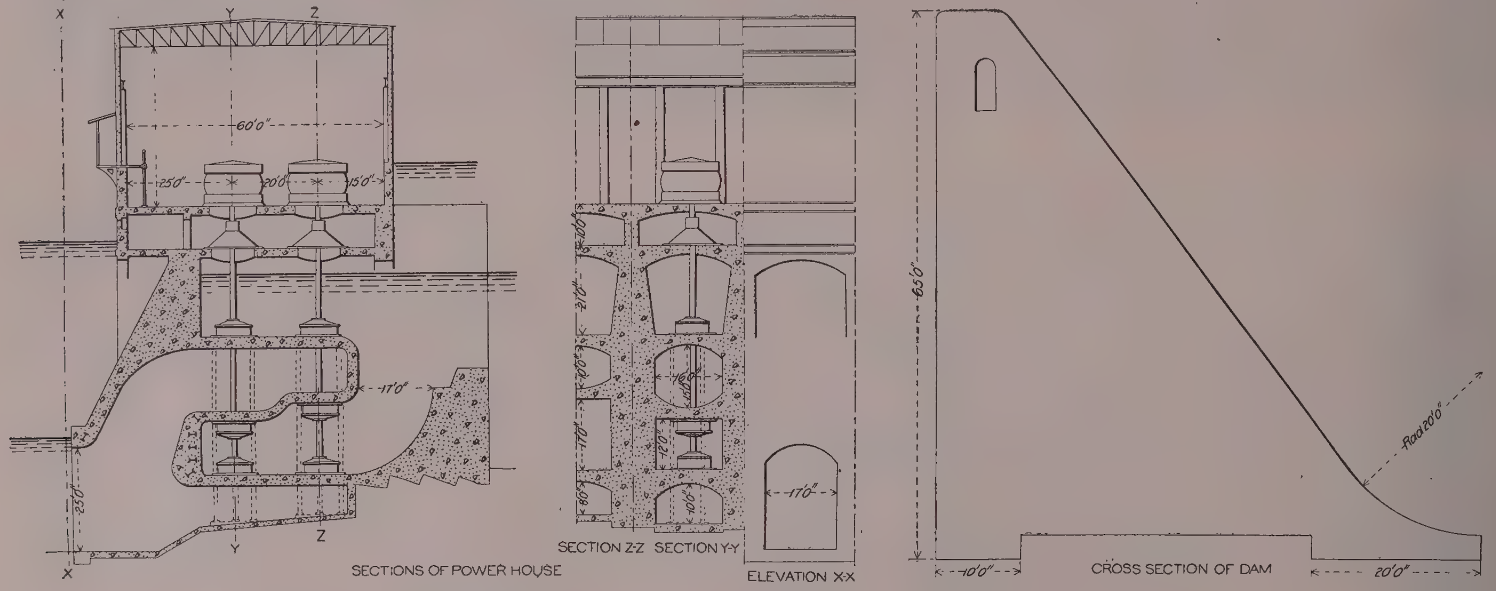
This is probably the first instance in which private interests have been permitted to dam an important navigable river, and the exceptional privilege is due to the desire of the United States Government to improve the navigation of the Tennessee River from Knoxville to the Cumberland Mountain Pass, a distance of about 150 miles. The principal obstructions to navigation here have been shoals and rapids, and hitherto Congress has been unwilling to appropriate sufficient money to remove them. In April of last year it authorized the Secretary of War to contract with certain citizens of Chattanooga for the construction of a lock and dam in the river at a point 12 miles below Chattanooga, in consideration of a grant by the United States to the builders of the water power thereby developed. Further engineering investigation showed that the site named was unsuitable, and that the dam proposed there would not sufficiently improve the navigation, so an amendatory act was passed providing for an indefinite location at some point farther down stream. In accordance with this provision the site has been fixed in the lower part of the Cumberland gorge. Active operations are in progress, and it is expected the plant will be in operation in the fall of 1907.

The plant comprises a concrete dam 1,200 ft. long, 50 to 60 ft. high, 8 ft. wide at the crest, and 65 ft. in extreme width of base; an earth dam 800 ft. long and rising 6 ft. above extreme high water, with a concrete core wall 4 ft. thick at the top and 6 ft. thick at the base and slopes of 2:1; a 64x200-ft. concrete power house, and a concrete lock with a 60x300 ft. chamber having a minimum depth of 7½ ft. of water over the sill and walls, 58 ft. high above the sill. The plans for the lock were prepared by Major H. C. Newcomer, Corps of Engineers, U. S. A., who, with Mr. John Bogart, chief engineer of the Chattanooga & Tennessee River Power Co., prepared the plans for the dam. The plans for the power house and for the hydraulic and electrical installation were prepared by Mr. Bogart, and all have been approved by the Chief of Engineers, U. S. Army.

A diagram has been made from the official records showing graphically the height of the water in the river at Chattanooga for every day for the last 20 years. This gives the seasons and comparative volumes of floods and drouths, which, being shown with the same abscissas and by different colored lines for consecutive years, are easily compared. A large number of less complete records for preceding years have also been plotted, and lines have been drawn on the diagrams showing the proportionate time when the flow would have been sufficient or insufficient to develop 40,000, 48,000, 56,000 or 60,000 h.-p. From a study of these and other data it appears that the minimum flow is seldom unable to provide for 40,000 h.-p. During most of the year there is an excess of water beyond what can be used by the plant, and for a large part of the time the excess is great. The government allows a fluctuation of 8 ft. to be caused in the level of the pool, thus providing for a considerable storage above the dam, which will be secured by raising the water 3 ft. above the crest by flash boards, and by drawing it down if necessary 5 ft. below the crest. In times of extreme low water it will probably be practicable to impound most of the flow above the dam for the 14 hours of night, and thus considerably augment the flow for the 10 hours of day service. The lowest flow on record is 5,000 cu. ft. per second, which, with the proposed construction, will have a head of 40 ft. As the flow increases the head is reduced and becomes only 20 ft. at extreme flood, when it is 250,000 cu. ft. per second.

These conditions made it very difficult to provide for a hydraulic installation to secure the highest efficiency at minimum flow and maximum head, and at the same time to maintain, as required by the electrical apparatus, reversed conditions of the same speed for the maximum flow and minimum head. The problem has been solved in a novel manner by Mr. Bogart, who has designed an interesting construction of power house and arrangement of turbines, which are set in groups of three on each vertical shaft, as shown in the general cross-section of the station. The two lower wheels have a high efficiency and do most work with a small flow and large head. Their maximum efficiency is attained with partial gate opening. The upper wheels are used with a large flow when there is an excess of water. The turbines will be from 57 to 60 in. in diameter and of special design, making about 120 r.p.m. They will be mounted on vertical tubular shafts suspended from the upper ends, and will be direct-coupled to the electrical units designed to deliver 4,000 e.-h.-p. Fourteen of these will be installed 26 ft. apart in two longitudinal rows, 20 ft. apart, in the power house.

The power house will have the switchboard gallery on one long side and the exciters at one end. The basement will be used for auxiliary machinery, and machinery will be installed in the power house to operate sluices with a capacity of 5,000 cu. ft. per second. The main room, 44 ft. high, will be commanded by a 50 or 60-ton traveling crane. The walls and floors will be of concrete, and the roof will be carried on steel transverse trusses. The interior will resemble that of the Niagara power house, where Mr. Bogart was consulting engineer, which has an installation of ten 5,000-h.-p. units.



Sections of Power House and Dam of the Chattanooga & Tennessee River Power Co.

At the site the sides and bottom of the valley are of rock, covered in the bed of the river with gravel about 15 ft. in maximum depth. The river has an ordinary current of about two miles an hour at low water, and the foundations for the lock, dam and power house will be carried down to solid rock in cofferdams sustaining a head of 5 to 15 ft. at ordinary stages of the river. The concrete in the main dam will contain large masses of very compact limestone quarried in rectangular blocks from the adjacent bluff. The principal quantities involved in the construction of the work now under contract are approximately 250,000 cu. yd. of earth, 80,000 cu. yd. of rock excavation and 150,000 cu. yd. of concrete.

Electricity will be delivered to Chattanooga, which is only 12 miles distant by land, by a three-phase overhead main, and it is expected that the entire output can be sold without difficulty instead of having to search for a market, as has been found to be necessary for some other hydraulic plants. Chattanooga and its suburbs have a population of about 70,000, it is the leading industrial town of its region, and is growing rapidly, forty new manufacturing plants having been established there last year.

The scheme for this plant was proposed and has been promoted by Mr. J. C. Guild, the well-known engineer and contractor of Chattanooga. Mr. W. J. Oliver is the contractor for the dam, lock and substructure of the power house.

The Mechanical Plant of the Hotel Gotham, New York.

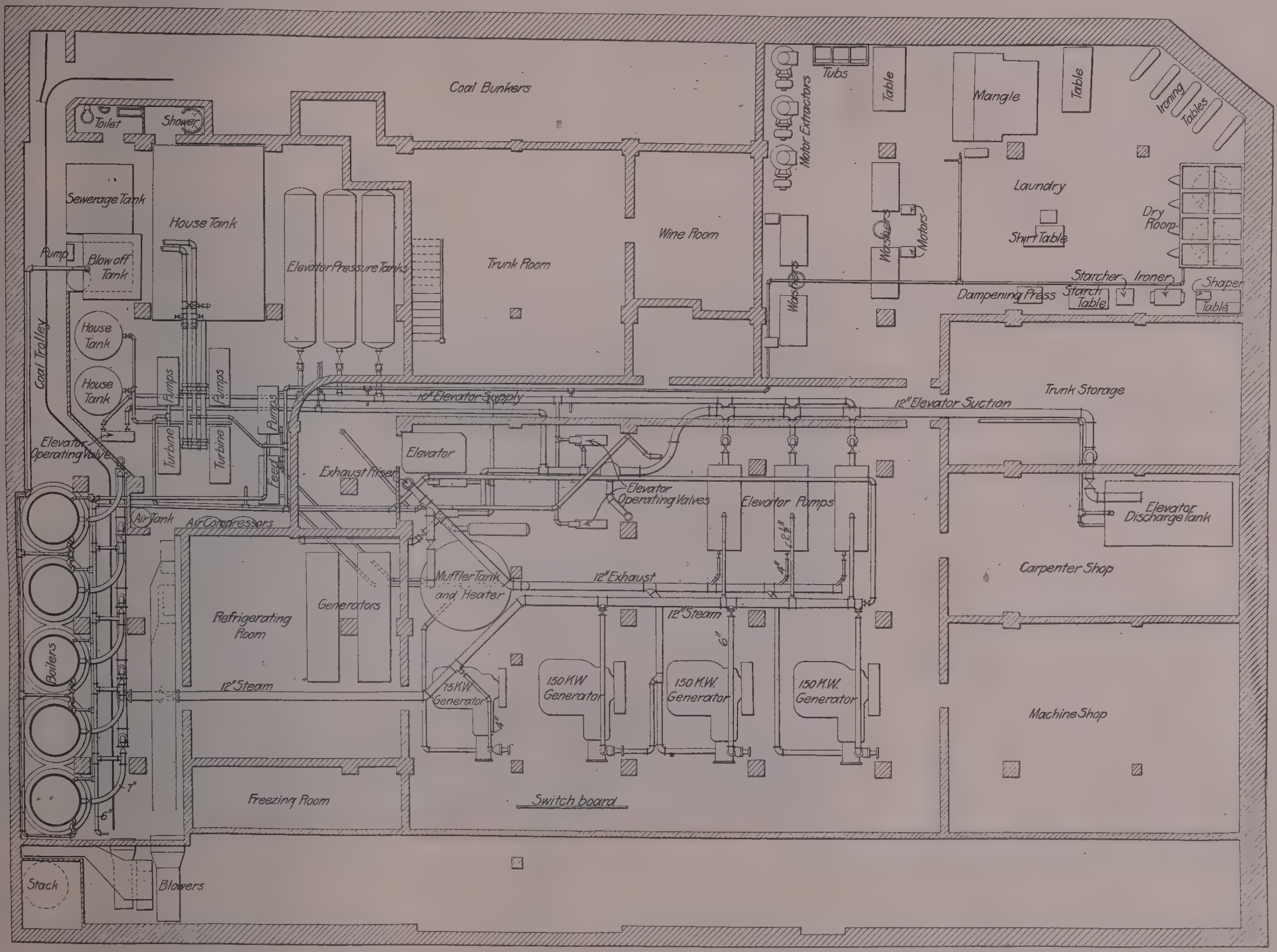
The Hotel Gotham is an apartment and transient hotel of the most luxurious type, which has recently been completed at Fifth Avenue and 55th St., New York City, at a cost of over three million dollars, and has an unusually comprehensive mechanical plant with numerous interesting details. The building is 22 stories high, with two basements, the lower of which together with the 22nd floor, is devoted to the mechanical apparatus. The first floor arrangement is unique among American hotels, there being no public lobby, the main parlor and the main dining-room opening directly off the office on either side. The second floor has a large parlor and reception room, and also a ballroom, while the floors above are devoted to the suites. The first basement contains a café, the kitchen facilities, storage rooms, etc. There are four elevators centrally located in the building which travel between the main floor and 21st floors, one of which is, however, devoted to the uses of the employees and freight, and has a travel down to the basement. There is also an auxiliary elevator from the first basement to the ballroom.

The mechanical plant centers in a 1,000-h.-p. steam and electrical lighting and heating plant, located in contracted quarters in the sub-basement, with a very complete equipment of auxiliaries. There is also the ventilating apparatus, an equipment of pumps, pressure tanks, etc., for the elevator system, a refrigerating plant, a vacuum sweeping system, a pneumatic tube despatch system, a well-equipped laundry and a machine shop, the arrangement of apparatus for which is indicated in the accompanying sub-basement plan. An unusually small amount of space was available, which made a very compact arrangement necessary, and in this connection a novel arrangement of the boiler plant is to be noted. Both on account of the lack of floor space and the difficulty of securing sufficient head room for the usual type of horizontal boilers, a vertical type was selected for which there is a special arrangement of boiler room, two stories in height, beneath the court, or air shaft space, at the rear of the building. The boiler room was thus confined to a very small floor area, 20 x 44 ft., for the five 200-h.-p. boiler units, or an equivalent of 0.88 sq. ft. per rated boiler horse power. In spite of the generally compact arrangement of equipment, however, generous amounts of working space were provided throughout and the plant is one of the most accessible to be found in any of the modern city business structures.

Boilers and Auxiliaries.—The boiler equipment consists of five vertical fire-tube boilers of the Manning type, the settings for which are arranged as indicated in the boiler room drawings. They are each 20 ft. 10 in. in height from base of mud ring to tube sheet, and with settings and smoke boxes at the top, set 25 ft. 10 in. above the boiler room floor. Sufficient headroom was, however, secured by extending the boiler space up through the first basement to the first floor level, this area occupied being that of both basements beneath the court space at the rear of the building. The room thus has excellent ventilation facilities and by means of vault lights above the boiler room profuse daylight lighting is secured. The boilers were moved into the building fully erected through the court space beneath which they set.

The boilers, which were built by the Bigelow Company, New Haven, Conn., are each of 200 h.-p. rated capacity, having heating surfaces of 2,000 sq. ft. and grate areas of 22 sq. ft. each. They have 284 2½-in. tubes, 15 ft. long, and are 74 in. in diameter above the furnace section and 90 in. below. The working pressure is 130 lb. The furnaces have plain dumping grates for hand-firing, and draft is supplied by a 6-ft. steel stack which rises over 200 ft. to above the roof line. The draft is automatically regulated by a Ford damper regulator, set in the main breeching and operated from the steam header; it is set to maintain the steam pressure at 125 lb. within 3 lb. on either side. The smoke flue leading to the stack is a No. 10 sheet iron duct, 4 ft. 6 in. by 3 ft. 2 in. in section; it passes in front of the smoke boxes, from which 2 x 3½ ft. connections with dampers lead into it.

A convenient and effective, yet unobtrusive, handling system for delivering coal to the firing floor is afforded by an overhead I-beam runway and traveling chain hoist, which delivers loaded buckets of coal from the coal vault under the sidewalk around through a 5-ft. passage into the boiler room. The buckets hold about 600 lbs. of coal. Ashes are also removed from the boiler room to the sidewalk hoist by the same method, a switch in the overhead runway permitting the the ash cans to be run off directly onto the sidewalk hoist, as indicated in the sub-basement plan. With the contracted layout of the boiler room and



General Plan of Mechanical Plant in the Sub-Basement of the Hotel Gotham.

the narrow passage leading to the coal storage, this overhead runway system is undoubtedly the most convenient of any that could be devised.

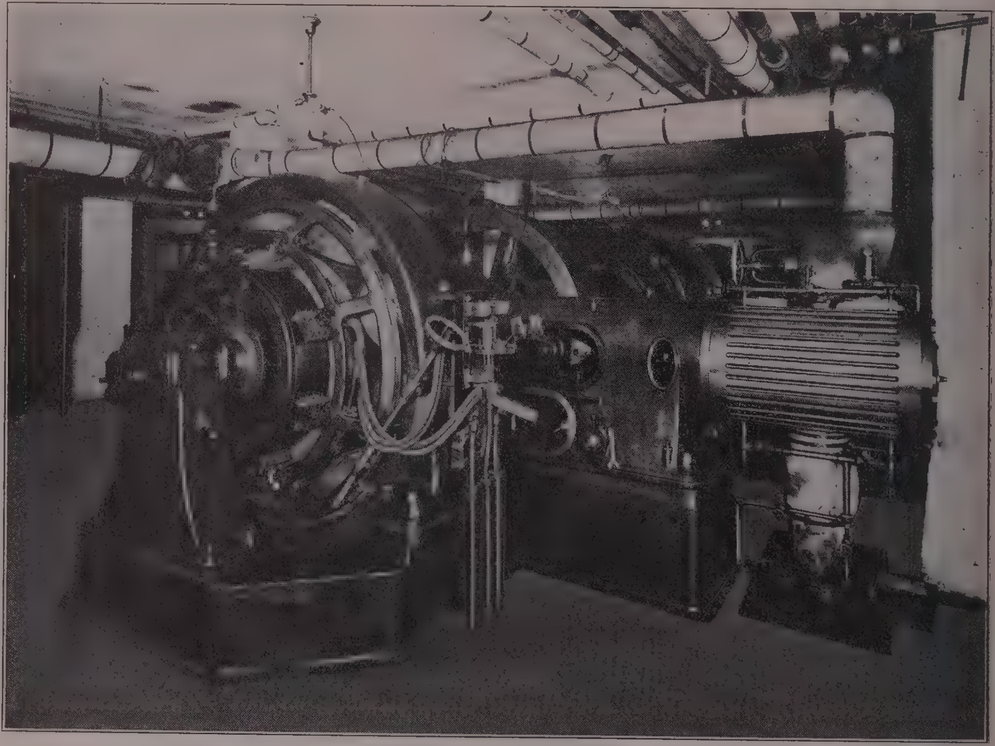
The boilers are fed by two 9 x 5¼ x 12-in. Worthington duplex boiler feed pumps, located in an adjoining room. Duplicate 4-in. supply connections are made to these from the feed-water heater and directly from the suction tanks for emergency service, while the delivery to the boilers is made through a 4-in. line with 2-in. branch feed connections to each. All of this piping is of galvanized iron with screwed flange joints. The feed pumps are controlled by 1½-in. Ford pump governors. The house suction tank, located at the rear of the pump room, is 13½ x 21½ x 10 ft. in size and has a capacity of 21,800 gal.

The blow-off system consists of 2½-in. blow-off connections from both the surface blow outlet and the mud ring of each boiler to a 3-in. blow-off main which leads to a 4,200 gal. tank at the rear of the pump room; this blow-off tank, which is 7 x 8 x 10 ft. in size, has a 4-in. connection to the street sewer, and a vapor pipe leading to the safety valve outlet line. The 4-in. street connection has two tees for by-pass connections to the sump pumps, between which is a gate valve, thus enabling these pumps to empty the tank if desired. The sump pumps, which are Worthington single-stage turbine centrifugal pumps, each driven by a 3-h.-p. motor, are connected also to the sump well for removing general drainage in the basement, and to the drip tank, the discharge being to the sewer through the tee mentioned above.

The boilers are equipped with Reliance safety water columns with high and low water alarms. The safety valves are provided with a 6-in. discharge line which opens into the smoke stack for removing the discharged steam from the boiler room; a ½-in. branch opens from this main out into the room to furnish a circulation of air through the line at all times. The boilers are covered with Carey 85 per cent. magnesia insulation, applied in two thicknesses of 1¼ in. each, with 1 in. air spaces beneath each. The smoke box is covered with 2-in. asbestos blocks so formed as to be readily removable. The breeching as well as the heater tanks, etc., is covered to a thickness of 4½ in. with two 1-in. air spaces, similar to that used upon the boilers. These coverings were furnished by the Covering & Supply Co., New York.

The feed-water heater is a Baldwin combined muffler tank, grease extractor, return tank and feed-water heater. It consists of a large tank through which the exhaust steam passes before entering the heating system in the building, and contains an arrangement of subdivided water surfaces for the interception of entrained lubricating oil in the steam from the engine cylinders. The tank has an area many times that of the exhaust pipe so that the velocity of the entering steam is suddenly arrested and the grease is easily intercepted by an arrangement of iron bars across the tank so located as to be partly submerged below the normal water level. The incoming jet of steam is directed vertically downward on this checkered surface of water. The contact of the entering steam with the clean water surface is effective in removing the entrained oil. The arrangement of the cross bars, or oil dams, as they are termed, is such that the oil accumulating on the surface of the water is continually driven downward by the blast of the incoming steam, leaving always a fresh surface on top, the oil and highly heated water passing off thence to a quiet side of the tank from which the former may be drawn off as necessary. The heating of the feed water is incidental to the process of oil separation. This tank is also used as a receiver for the drips from the heating system drip tank, and also the various drips from the high-pressure steam mains, engine cylinders, etc., and the steam jackets in the kitchen and laundry which discharge through Nason steam traps. There are four systems of 2-in. drip line leading from the various apparatus to this heater, which is an 8-ft. steel plate cylindrical tank, 12 ft. in diameter and has 12-in. exhaust steam outlets and inlets and 4-in suction connections to the feed pumps.

Piping.—The steam piping is simple yet reliable, consisting of a 12-in. main header in the boiler room connecting with a 12-in. engine room line, and a 6-in. auxiliary header which supplies the auxiliaries and, for reliability, is tied into the engine room line at its farthest end, thus forming a species of ring main, enabling the engines to be operated from the auxiliary header in case of damage or repairs to the main header. The main 12-in. header is located in the upper portion of the boiler room, individual connections to the various boilers being made through long-radius bends of 7-in. pipe; just before entering the upper side of the main header, however, 3-in. branches are taken off to supply the auxiliary 6-in. header, as shown in the detail drawings. Both headers are liberally provided with sectionalizing valves for division of the service, for cutting out any one of the boilers, branch lines, etc.



Generating Units of the Hotel Gotham Mechanical Plant.

The engine room line is carried on the ceiling of the sub-basement, thereby necessitating a drop connection of 8½ ft., as the main header is carried at a level of 19½ ft. above the boiler room floor or near the first floor level. This drop leg is supported by a simple yet effective truss of angle-iron construction, which spans the gap of 16 ft. between adjacent building columns, the point of support being at the base of the tee from which the drop connection is made. This line passes thence to the engine room, where branches are made to the engines, one of 4-in. pipe and three of 6-in., and three branches of 2½-in. pipe to the elevator pumps, as shown.

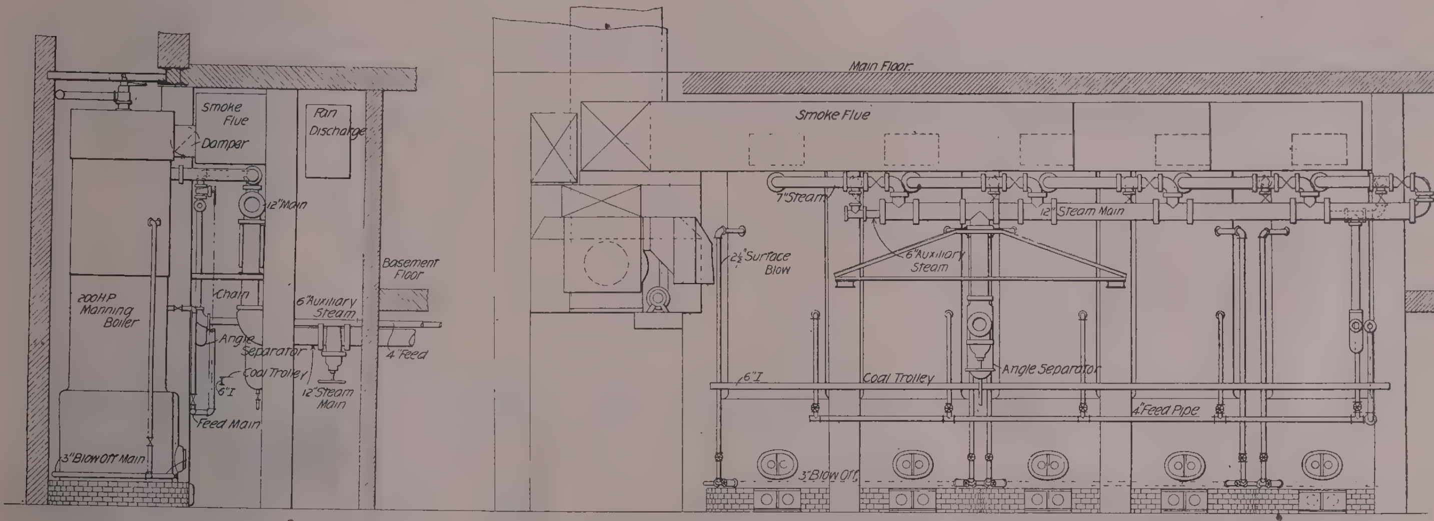
The auxiliary header connects to a 6-in. main leading first to the pump room, from which branches are taken to the boiler feed pumps, the air compressors, the refrigerating apparatus, etc., and then it passes along to a connection with the laundry apparatus, and finally with the engine room main. The supply for domestic purposes in the kitchen and the laundry, and also for supplementing the exhaust steam for heating when the latter is insufficient, is taken from the auxiliary main; the former, which includes the supply of steam at 60-lb. pressure to the laundry and kitchen services and to the pantries on the upper floors, is taken through a Ford reducing valve to a 4-in. distribution line, while the latter is similarly made through a 4-in. Ford reducing valve set for a delivery pressure of 5-lb., both of which reducing valves have 2-in. by-passes.

The exhaust piping system of the power plant is run in trenches covered with checkered iron cover plates. It consists of a 12-in. main carried on rollers in a large trench between the engines and elevator pumps in the engine room. This main is connected with the exhaust muffler tank and feed-water heater, and from the latter a connection is made with the exhaust riser leading through the elevator shaft to the roof. The muffler tank is by-passed so it can be cut out of service when desired. From the bottom of the exhaust riser there is a drop leg from which branches are taken off to supply two Berryman hot-water heaters in the adjoining room, and the generators of the refrigerating system. The exhaust riser is of light-weight wrought-iron pipe and is anchored at the basement, ninth and twentieth floor levels, with two sleeve expansion joints between. At the twentieth floor level there is a tee in this line from which the supply to the heating system on the building is taken off; above this is a 12-in. Ford back-pressure valve for relief to the atmosphere in case of excessive pressure in the system, which is provided with a chain extending down to the basement for operation from there if desired. The riser ends above the roof in a galvanized-iron exhaust head from which there is a drip connection leading down to the return tank. All of the high pressure piping tanks, heaters, etc., have been covered with molded sectional covering containing 85 per cent. of magnesia, with canvas outside jackets, while the low pressure piping and apparatus was covered with air-cell covering, the contractors for which were the Covering & Supply Co.

Engines and Generators.—The generating equipment of the power plant comprises three

160 k.w. and one 75-k.w. Sprague Electric Co. compound-wound direct-current generators which are direct-connected to simple, non-condensing horizontal center-crank engines, built by the Ball Engine Co., Erie, Pa. The three larger engines have 18-in. cylinders with 16-in. stroke and operate at 230 r.p.m., while the smaller unit has a 14 x 14-in. cylinder and is operated at 275 r.p.m. Close speed regulation is effected by the use of the Robb-Armstrong-Sweet inertia shaft governor of this company. The valves are of the new spring-actuated telescopic type which has been introduced in the Ball Engine. The larger units occupy floor spaces of 10¾ x 14 ft., while the smaller unit takes a space of 8¾ x 11½ ft.

The electrical generators are engine-type multipolar machines, over-compounded about 10 per cent. for better regulation. They deliver direct-current at a potential of 250 volts and according to the above ratings are capable of 25 per cent. overload continuously. The distribution is entirely on the two-wire system, to the entire exclusion of the three-wire system, this being a new departure rendered practicable by the possibility of securing satisfactory high-voltage incandescent lamps. The entire lighting system and all the motors are operated at 235 volts, there being over 6,000 incandescent lamps connected up in the building and a large number of motors which, with the generating equipment, were supplied by the Sprague Electric Co., New York.



Front and Side Elevations of Boiler Room Equipment.

The electrical distribution system is controlled by a five-panel marble switchboard, having two panels for the generators and three for the outgoing feeders, of which there are 30 circuits in all, divided into three groups, one for the basement or service section, one for the public portion of the building and the third for the apartments and suites on the upper floors. The switchboard also contains, on the upper portion of one of the panels a high-pressure steam gauge, one for the intermediate pressure steam for kitchen and laundry service, another for the exhaust heating system, and two for the compressed air systems, one for either pressure. The switchboard was supplied by the Crouse-Hinds Co.

Water and Compressed Air.—The water service of the building is of interest in that it is handled by turbine pumps at two different pressures for different elevations in the building, the building in fact being for this purpose divided into three sections. The first section embraces the basements and lower floors up as far as the fourth, which are supplied directly from the city mains, while the second section, from the fourth to fourteenth, is supplied at a pressure of 60 lb. and the third, from the fourteenth to the twenty-first floors, at 125 lb. For the intermediate pressure supply there are two Worthington two-stage turbine centrifugal pumps, each of a capacity of 185 gal. per min., while for the 125-lb. pressure service there are duplicate three-stage Worthington turbine pumps, each of 275-gal. capacity. All of these pumps are direct-connected to Sprague motors, those operating the 125-lb. pumps being 40-h.-p. motors and those on the intermediate pumps 20-h.p. The high-pressure system, which serves also as the fire service system, is supplemented by three house tanks on the roof, which together hold nearly 20,000 gal., while for the intermediate system there are, in the basement, two 10-ft. tanks, 72 in. in diameter, in which an artificial head is produced by air pressure. All of the water supply used in the building is filtered before use, for which there are installed four stone water filters, having an aggregate capacity of 50,000 gal. per 24 hours; these were supplied by the Loomis-Manning Filter Co.

The compressed air supply is furnished by two 11-in. Westinghouse locomotive-type vertical steam air compressors, one furnishing a pressure of 185 lb. and the other, 350 lb. For the intermediate pressure there is a 9-ft. tank, 36 in. in diameter, and for the higher pressure, an 8-ft. tank, 30 in. in diameter. The lower pressure air supply is, in addition to the intermediate tank service, used for the operation of an Ellis sewage lift, which raises the sewage out of an 8 x 8 x 5-ft. sewage collecting tank for the basements into the street sewers above. The high-pressure air is used in the elevator pressure tanks for cushioning and expansion effect, there being six of these tanks which are kept one-third full of air.

Elevators.—The elevator equipment consists, as above stated, of three passenger elevators traveling from the main to the twenty-first floor, a freight and employes' elevator traveling from the basement to the top, and a special ballroom elevator which has a travel only from the first basement to the second floor. All are of the plunger type and were installed, with the necessary equipment of pumps, pressure tanks, etc., by the Plunger Elevator Co., New York. The four traveling to the top floor are located in an enclosed shaft in a central location in the building and have the well-known differential valve system of control of this company, with automatic stops at top and bottom. The ball-room elevator, which is located at one side of the building, however, has a novel method of electrical control. It has an electro-magnetically operated pilot valve, controllable from the car, which is used to divert the pressure in the regular main hydraulic operating valve as required for the proper operation of the car. The details of the new system are illustrated in an accompanying drawing. The usual rope or cable-operated connection from the car to the pilot valve is here replaced by a three-conductor electrical cable leading from a special two-point operating switch in the car to a pair of magnets which effect the opening of the up or down pilot valves. Only one of these can be opened at one time, the result of which is, in either case, to admit the hydraulic pressure to a cylinder which in turn admits the pressure to the plunger cylinder or opens it to exhaust. The effect of the closing of the pilot valves is to arrest the motion of the car, so that as the operating switch in the car is normally held at its neutral position, the car will stop as soon as the operator's hand is removed from the switch. The limit stop machinism used for this elevator has a special cam device which is actuated, through gearing and radial arm, only when the car reaches the end of its upward or downward travel.

The hydraulic pressure supply for the elevator system is furnished by three compound duplex elevator pumps located in the engine room, which were built by the Platt Iron Works. These pumps each have 14 and 20 by 10 by 15-in. cylinders and deliver against a pressure of 250 lb. They deliver through a 10-in. main to the elevator operating valves and to the pressure tanks, their suction being taken through a 12-in. main from the discharge tank, which is a rectagular steel tank, 8 x 16 ft. in plan and 8 ft. deep. Each of the six pressure tanks is an 18½-ft. cylinder, 48 in. in diameter. These tanks are arranged horizontally in two tiers, and are kept one-third filled with air, for which purpose the high-pressure air compressor is used. The operation and control of the four main elevators are in accordance with the usual standards of the Plunger Elevator Co., and the operating valves are located in the engine room in close proximity to the plungers. The three passenger elevators have 265-ft. plungers, while that of the freight elevator is 275 ft. long.

Miscellaneous Equipment.—Other features of the mechanical equipment are a pneumatic tube system for the delivery of messages to the various floors, a vacuum cleaning system and a complete laundry equipment. The last embraces washers, centrifugal dryers, mangles, ironers, drying ovens, ironing tables, etc. All of the machinery in this department is electrically driven, the motors being individually applied in all cases to the exclusion of all line shafting. The convenience of the self-contained individual drive is here evident from the fact that all of these machines are rendered portable and can be re-arranged at will as may be required by the service;

this has in fact occurred, a complete re-arrangement of the apparatus having been made since the original installation. For use at the ironing tables there is a complete equipment of electrical flat-irons with safety devices for preventing over-heating, which was supplied by the Simplex Electric Heating Co. The entire laundry equipment was supplied by the Troy Laundry Machinery Co., with the exception of the large mangle, which was built by the American Laundry Machinery Co. A novel feature has been incorporated in the equipment in the form of an electrically-heated collar and cuff ironer. All of the machines are driven from Sprague motors through Morse silent chains.

The pneumatic tube despatch system comprises a central despatching station on the second floor of the building in the clerk's office, from which individual tubes are carried to operating desks in the corridor on each of the upper floors and also to the main offices, to the engine room and to the laundry. The purpose of this system is the delivery of small parcels, mail matter, messages, etc. Compressed air is supplied at 2½-lb. pressure by a compressing plant in the sub-basement, which consists of a Knowles 10 x 20 x 24-in. steam air pump, automatically controlled by a Ford pump regulator to maintain a pressure of 8 lb. in the storage system. The latter consists of a 10-ft. cylindrical tank, 60 in. in diameter, which serves as a main source of storage. The supply for the system is, however, taken from a smaller service tank into which air from the larger tank is delivered through a reducing valve set for a delivery of 2½ lb. This despatching system was installed by the Miles Pneumatic Tube Co., New York.

The sweeping and cleaning system is the well-known Kenney vacuum system of cleaning of the Vacuum Cleaner Co., New York. Two 2½-in. vacum riser lines extend vertically through the building with outlets at each floor for the connection with the hose to which the brush renovators for the cleaning process are attached. The riser is connected to the vacuum pumps and separators in the sub-basement, the latter performing the process of freeing the air of the entrained dust and dirt. This equipment consists of the usual rotary centrifugal dry separator, following which is the wet-process separator in which the air is passed through a water bath. The vacuum is supplied by two of the motor-driven Kenney vacuum pumps, each of which is driven by an 8-h.-p. Sprague motor through a chain drive.

Refrigerating System.—The refrigerating plant consists of a Carbondale refrigerating machine, capable of cooling 100 gal. of brine per minute from 10° to 0°, with duplicate ammonia pumps, which is used to make six tons of ice per day on the can system and cool the various refrigerators to the usual temperatures for the preservation of food products. The brine storage tank is in the cellar in a room adjoining the ice machine, and the suction pipe runs overhead to the two brine pumps in the ice machine room, which are of the Deane duplex type 8 x 7 x 10-in., brass fitted. These pumps deliver brine through the Carbondale brine cooler located in the engine room and from there the brine is distributed to the following refrigerators: Meat and poultry, 12 x 12½ x 7½ ft.; poultry, 7 x 12½ x 7½ ft.; fish 6 x 3 x 3 ft.; vegetable, 7 x 5 x 7½ ft.; cooks' refrigerator, 12 x 6½ x 7½ ft.; pastry, 8 x 3 x 6 ft.; ice cream, 10 x 3 x 3 ft.; pantry, 10 x 3½ x 6 ft.; order, 4 x 4 x 5 ft.; fish, 3 x 4 x 3½ ft.; oyster, 8 x 3½ x 6 ft.; garde manger, 6 x 2 x 6 ft.; wine, 13½ x 6 x 7½ ft.; garbage, 10 x 7 x 6 ft.; garde manger, 3 x 20 x 6 ft.; butter and cheese, 5 x 6 x 7½ ft.; milk, 10 x 6 x 7½ ft.; back bar, 18 x 4 x 4 ft.; vegetable, 10 x 10 x 10 ft.; wine, 10 x 10 x 10 ft.

All the brine mains are covered with Nonpareil cork brine pipe covering and all the coils in boxes are galvanized.

The ice tank, located in the basement adjoining the kitchen, is about 11 ft. long and 21 ft. wide and contains 150 ice cans holding 100 lb. each, and has a traveling crane and can dump for handling the ice. This machine is operated by steam, 40 boiler horse power being sufficient to do the entire work. The water from the machine runs into a storage tank and is used for various purposes throughout the hotel.

Heating and Ventilation.—The heating of the building is accomplished by direct radiation throughout, with the exception of the greater part of the first floor and the ballroom, in which fan blast systems for ventilation purposes assist in the heating by indirect radiation. In all of the suites and rooms pleasing radiator arrangements have been secured by locating them in recesses underneath the window sills over which are placed ornamental iron screens. The radiators, which are of the narrow loop type of the American Radiator Co., are supplied on the one-pipe down-feed system, with air valves, from a connection in the 12-in. exhaust riser at the twentieth floor level. From here a supply main is extended horizontally across in the suspended ceiling underneath the twentieth floor, from which branch connections are taken off to supply the heating risers extending vertically through the building. All of these heating risers are anchored at the fourth and fourteenth floors to the floor framework, while at the ninth floor level there are expansion joints, consisting of U-shaped return bends about 12 ft. long, extending under the floor and connected to the ends of the riser by swiveling joints. There is connected to the heating system at the roof a snow-melting system for freeing the gutters and leaders of snow and ice in the winter; this consists merely of a system of steam jets projecting through the cornice at intervals, with valves for graduating the steam supply.

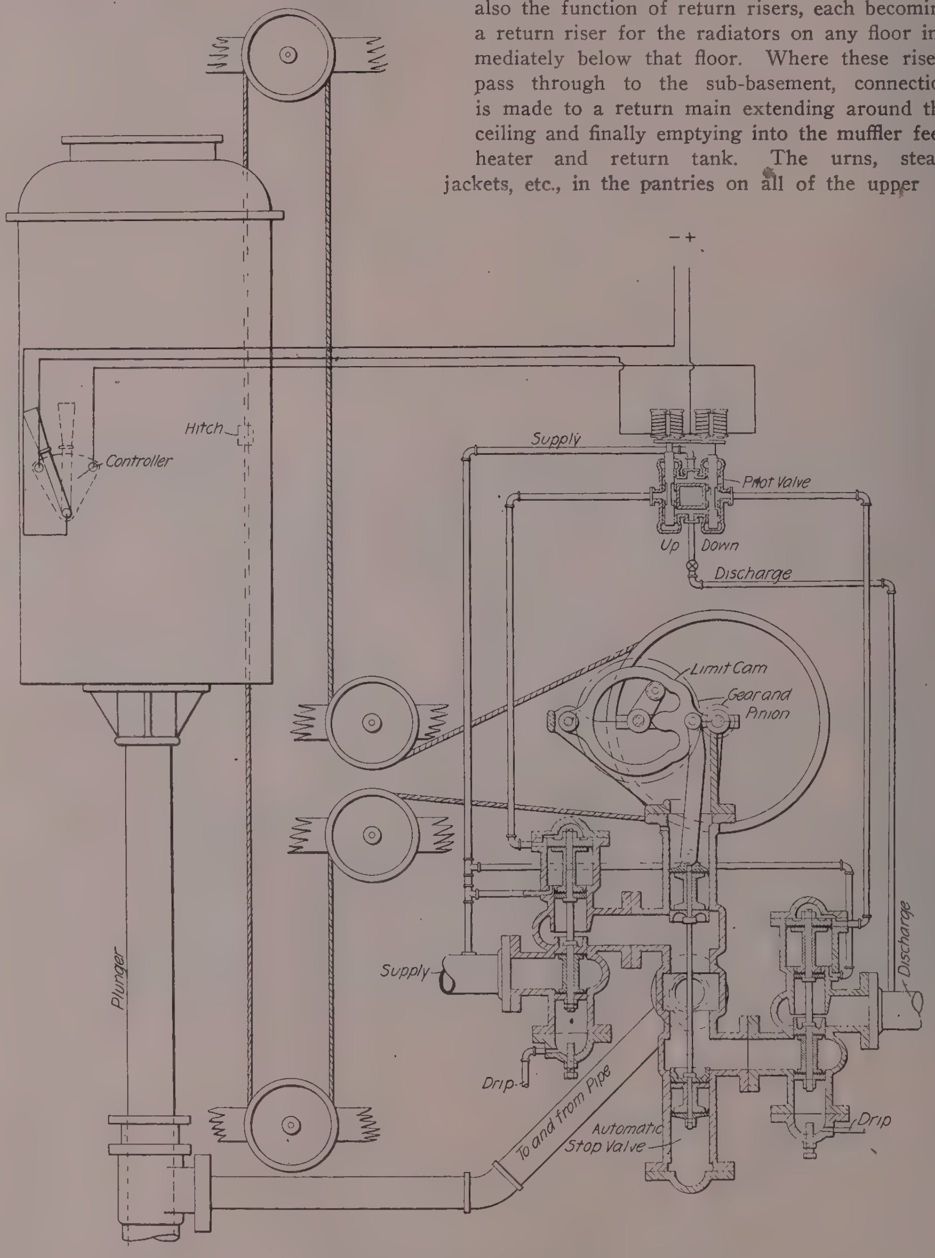
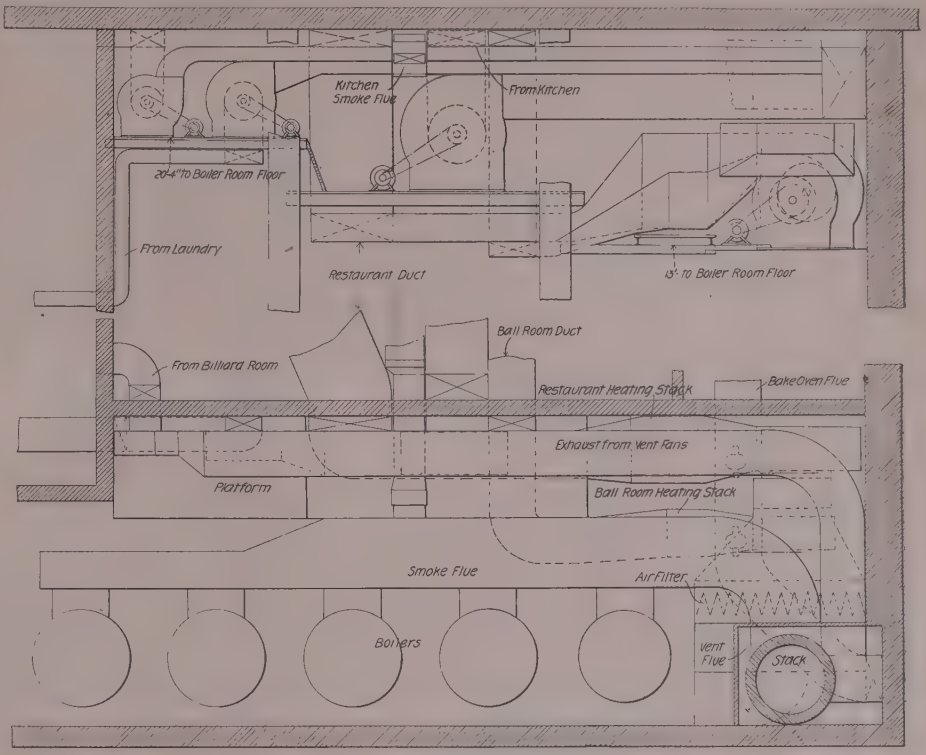


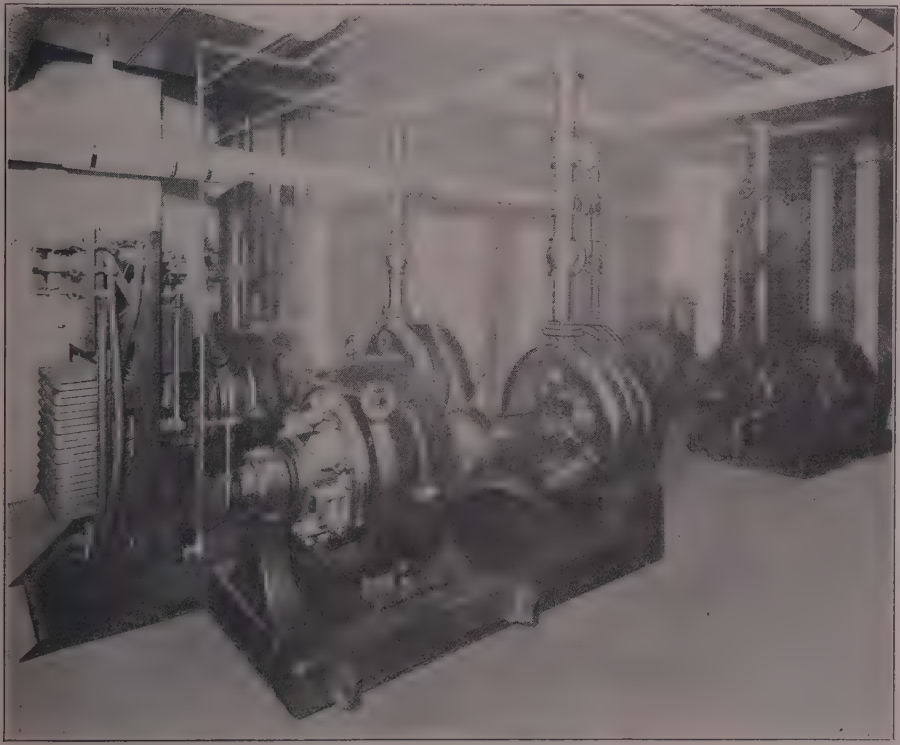
Diagram of Apparatus for Electric Control of Elevators.

The down-feed heating risers, receiving their steam supply at the twentieth floor level, serve also the function of return risers, each becoming a return riser for the radiators on any floor immediately below that floor. Where these risers pass through to the sub-basement, connection is made to a return main extending around the ceiling and finally emptying into the muffler feed heater and return tank. The urns, steam jackets, etc., in the pantries on all of the upper floors, and also the heating stacks of the fan blast systems, are served by a separate two-pipe system for the supply of steam at 60-lb. pressure, and for the return of their condensation. The air valves on the radiators connect to systems of ⅛-in. pipe on each floor, all of which connect to a ¾-inch riser leading to the sub-basement and into the sump. At all places where the risers or other pipes pass through the floors in chases the spaces around the pipes were fitted with wire lath and covered with 1½ in. of plastic asbestos.

There are two blowers which deliver air to the restaurant and palm garden on the main floor and, to the ballroom on the second. These blowers are located on a platform at one end of the boiler room, which is sufficiently elevated to provide ample headroom beneath. A fresh air intake duct, 24 x 72 in. in cross-section, is carried down alongside the stack to them from a protected opening in the court on the west side of the building, passing first through a series of air filters. The duct opens out to an area of 8 x 10 ft. in vertical cross-section for the filtering screens, which are of the usual cheese-cloth type, arranged on zigzagged vertical bar supports, giving a total filtering area of about 150 sq. ft. of the cloth. From the filtering chamber the duct reduces again to its normal area of 24 x 72 in. and passes over and down to the blower inlets. The blowers consist of a 70-in. right-hand fan of 3,800 cu. ft. capacity per minute for ballroom and a 90-in. left-hand fan of a capacity of 7,000 cu. ft. of air per minute for the service of the restaurant and palm garden, both of which fans are located side by side with the fresh air intake connection between them for economy of room, as shown in the drawings. Both fans are of the full-housed type with top horizontal outlets and are driven through Morse chain drives to insure noiseless operation, the 70-in. fan at 135 r.p.m. by a 3-h.-p. Sprague motor and the 90-in. fan at 120 r.p.m. by a 4-h.-p. Sprague motor. For the restaurant and palm garden heating, the duct is equipped with a heating stack of six sections, each 4 ft. by 6 ft. 10 in., containing the equivalent of 2,568 lin. ft. of 1-in. pipe; the ballroom duct has a heating stack of two sections, each 3 ft. by 4 ft. 4 in., containing the equivalent of 386 lin. ft. Both of these stacks are of the standard indirect type of the Buffalo Forge Co. with cast-iron bases and built up of 1-in. pipe set staggering.



Arrangement of Blowers in Boiler Room.



High Pressure Turbine House Pumps at the Hotel Gotham.

There is also an extensive equipment of exhaust fans for ventilation purposes in the basement and elsewhere. Three of these are located on platforms in the boiler room opposite the boilers and serve for the ventilation of the billiard room and the kitchen in the basement and the laundry in the sub-basement, the arrangement of ducts and their connections being well shown in the drawings. The billiard room vent is connected with a 50-in. top outlet fan of 1,500 cu. ft. capacity, driven at 150 r.p.m. by a 1-h.-p. motor; that from the laundry is connected with 60-in. fan of 1,800 cu. ft. capacity, driven at 100 r.p.m. by a 1-h.-p. motor; while the kitchen is ventilated by a 90-in. 6,600 cu. ft. fan operated at 115 r.p.m. by a 4-h.-p. motor. The discharges from these, as well as the other basement vent fans, lead to a rectangular shaft, 6½ by 9¼ ft. in section, which encases the 6-ft. steel stack and, rising to the roof, serves as a vent discharge; an important feature of this arrangement lies in the fact that in addition to the heat insulating effect of the rectangular duct, it has a strong natural draft due to the heat radiated from the stack so that its capacity is much greater than would otherwise be the case. Other ventilation for the basement is provided by a 48-in. 4,560 cu. ft. fan for the store room, a 24-in. 5,000 cu. ft. fan for the locker room, and an 18-in. 2,100 cu. ft. fan for the toilet room; these are driven by 1, ¼ and ⅛-h.-p. motors, respectively, and discharge into the vent stack. The chimney draft for the kitchen ranges is made positive by a 24-in. cone exhaust fan of 2,100 cu. ft. capacity, which exhausts the range flue into the main smoke stack.

Additional ventilation facilities for the building are provided in three cone fans for the dumb-waiter shafts and nine cone fans on the roof for exhausting from the wall vent flues from the various rooms, baths, etc. The dumb-waiter shaft fans are all 60-in. cone fans of 10,500 cu. ft. capacity, each driven at 200 r.p.m. through silent chain by 2-h.-p. motors. Of the flue exhaust fans there are seven 42-in. fans of 2,300 cu. ft. capacity and two 48-in. 3,500 cu. ft. fans, all driven at 150 r.p.m. by 1-h.-p. motors. The cone fans were all built by the Baldwin Engineering Co., the blowers, however, having been supplied by the Buffalo Forge Co. The motors operating the fans, as well as those for other power purposes in the building are of the Lundell type, supplied by the Sprague Electric Co., New York, and operate on the 230-volt two-wire system of the building.

The Hotel Gotham was erected for the Fifty-Fifth Street Co. by the General Building & Construction Co., New York, which was the general contractor for its construction and equipment. Messrs. Hiss & Weeks were the architects and Mr. George Hill the consulting engineer for the mechanical equipment. The Baldwin Engineering Co., New York, was the contractor for the steam plant and general heating and ventilating equipment, the electrical work having been in charge of the Contractors' Electrical Co., of Brooklyn. Mr. E. N. Garnsey is superintendent of the building and Mr. C. K. Van Etten chief engineer.

NEW STREETS in London are divided into five classes by the Advisory Board of Engineers of the London Traffic Commission. For the least important class the sidewalks should be 8 ft. wide each, and the roadway at least 24 ft., it is stated, and for the most important avenues the sidewalks should be 23 ft. each and the roadway 94 ft.

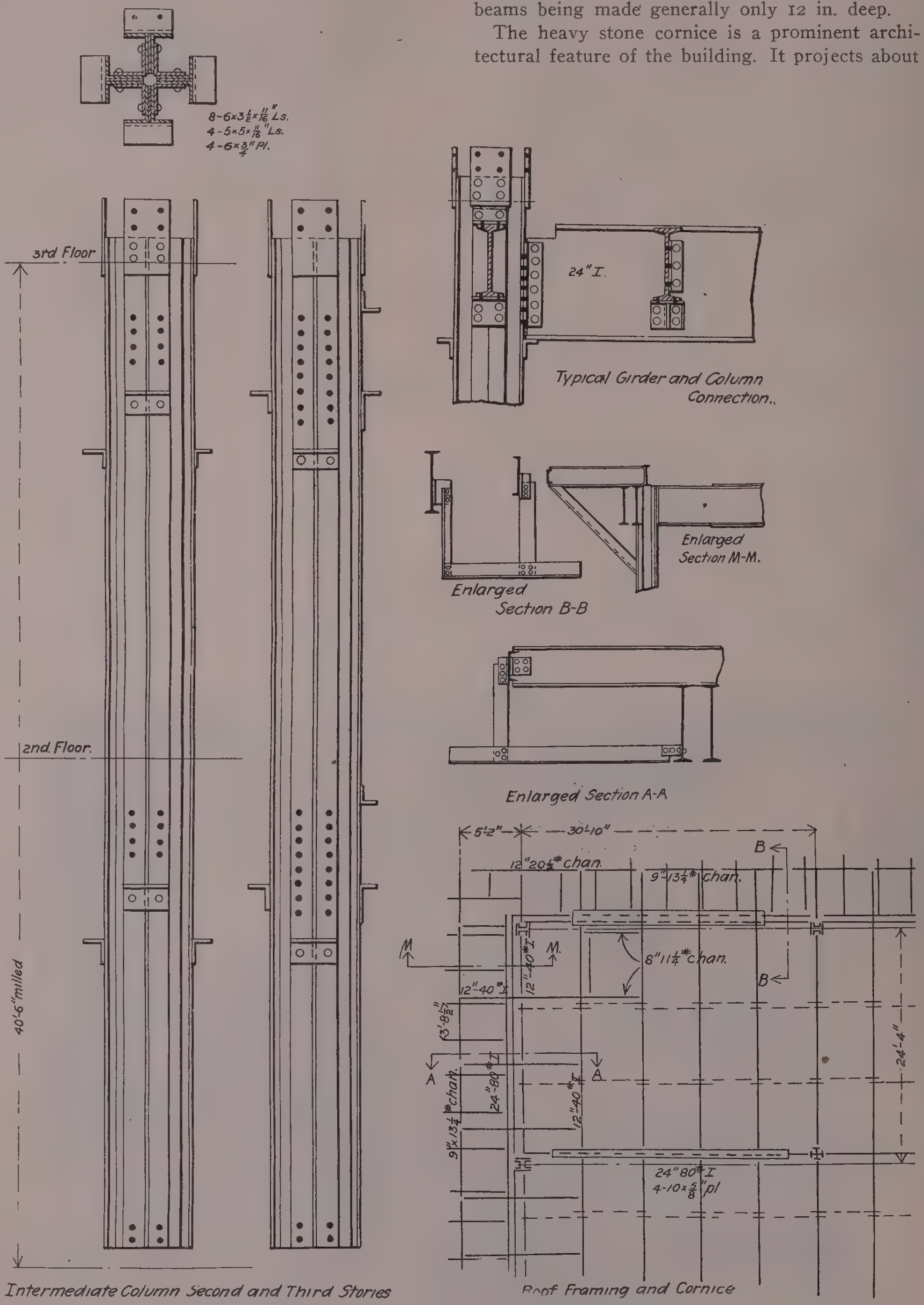
The New Altman Building, New York.

The new Altman Building in New York is designed for the uses of a department store, and will be one of the largest buildings of its kind in the city. It is rectangular in plan, except for some irregularities in the site at one end corresponding to the varying limits of the small lots contained in it. It has a front of 197 ft. 6 in. on Fifth Ave., 275 ft. on 34th St., and 325 ft. on 35th St. It will be eight stories in height, besides the basement and cellar, and will have a central 64 x 64-ft. open court. At present a 28 x 94-ft. building occupies the corner of 34th St. and Fifth Ave. and cannot be removed until the expiration of its five-year lease, therefore the new building will be constructed around it, with temporary walls enclosing it, and provision is made in the framing of the columns and girders for an extension of the new framework to the street lines when the structure is removed. The three street fronts will be of granite in the lower stories and in the upper stories will be of limestone, imported from France.

The building is of fireproof steel-cage construction throughout, and is somewhat remarkable for the uniformity and simplicity of the steel construction, which is arranged in regular panels having little variation except as modified for the elevator and stairway shafts. All steel work is protected by brick, concrete or plaster, all connections are field-riveted, and all floors are uniformly proportioned for live and dead loads of 120 and 90 lb. per square foot respectively. The great lateral dimensions and weight of the building, the stiffness of its deep girder connections and partitions, and the resistance and distributing effects of its floors provide so amply for wind and sway stresses that no special bracing for them is required.

The building, as now being constructed, exclusive of the southwest corner, contains 134 main columns arranged in fourteen rows from 23 ft. 8 in. to 30 ft. 10 in. apart, parallel with Fifth Ave., and ten rows from 20 ft. to 24 ft. 4 in. apart, parallel to the cross streets. All columns are made in two-story lengths, spliced 5 in. above the floor lines, and are seated on separate small grillages of single tiers of I-beams bedded in concrete on rock, which required considerable excavation for the cellar. All of the wall columns have closed rectangular cross-sections made of two channels and two cover plates, and are completely enclosed in the masonry. The dimensions of the interior columns were required to be such that they could be enclosed in cylindrical shells 16 in. in outside diameter. Therefore, they are made of the patent Gray type, built up of four pairs of flange angles, four connection angles, and four cover plates. A typical column in one of the lower tiers is made of eight 6 x 3½ x 11/16-in. angles, four 5 x 5 x 11/16-in. angles, and four 6 x ¾-in. flange cover plates, all 40 ft. 6 in. long, and weighs about 13,070 lb. The splices are made with four short flange plates shop-riveted to the top of one section and field-riveted to the bottom of the next section above. All beam and girder conections are made on the center lines of the column, with shelf angles to support the the lower flanges. The horizontal legs of these angles are not reinforced, and in most cases similar angles are provided to receive the top flanges of the beams and girders, both top and bottom angles having one rivet through each side of the the flange. The heavier girders are also web-connected to the column flanges with eight to sixteen field-driven rivets.

In the regular panels the columns are connected by 24-in. 80-lb. I-beam girders parallel to 34th St. The top and bottom flanges of these girders are reinforced by single 10-in. cover plates from ⅜-in to 11/16-in. thick, and from 13½ to 16½ ft. long. In the 30 ft. 10 in. panels, next the Fifth Ave. front, the cover plates are double and are 26 ft. long in some cases. Around the light court, which occupies nine panels, the girders are made of 20-in. 65-lb. I-beams without reinforcement flange plates. Girders for the 24-ft. 4-in. panels have end reactions of 21 tons, for which twelve ¾-in. field rivets are provided in the column side of the connection angles and six shop rivets with ½-in. bearings on the girder web. Where the girders carry the mains of the automatic fire sprinkler system, their upper flanges are notched at the columns to receive them below floor level. The floors and roof are of segmental hollow-tile arches supported on 15-in. I-beams of 42 or 50 lb. per foot, and from 5 ft. 7 in. to 6 ft. 2 in. apart. These beams are web-connected to the girders by three shop-driven rivets through the girder web and three field-driven rivets through the beam web, and are also seated on shelf angles with reinforced horizontal flanges. In most cases the wall masonry is carried on double I-beams supported by gusset plates on the exterior columns. In the second and seventh floors these double beams are replaced with plate girders 24 in. deep, with 5 x 3½-in. flangle angles to support heavy stone masonry over the wide openings which are a structural feature of the building. In order to receive the hangers for these stones the girders are made with double web plates separated 1 in. by fillers. The roof framing is substantially like that of the floors, but lighter, the girders having their flanges reinforced only in the longest panels and the beams being made generally only 12 in. deep.



Details of Steelwork in the New Altman Building, New York.

The heavy stone cornice is a prominent architectural feature of the building. It projects about 6 ft. beyond the face of the wall and is supported on a simple system of cantilever roof beams. On 34th and 35th Sts., the 12-in. roof beams are supported at their inner ends by the direct connections to the columns and main girders and near the opposite ends are seated on the top flanges of the double wall girders or on the tops of the wall columns, beyond which they project 4 ft. The cantilever ends are connected by 9-in. channels from which are suspended the outer ends of pairs of horizontal angles 5½ ft. long, supported at their inner ends by the wall girders. As the roof beams are parallel to the Fifth Ave.

front, the construction there is modified by substituting for the projecting roof beams, shorter 12-in. I-beams with their fulcrums on the wall girders and anchored at their inner ends to the webs of the first roof beams. Here also the intermediate beams are supported at their inner ends on the top flanges of the wall girders, and at their outer ends are kneebraced.

As the Fifth Ave. side of the building has no sub-basement, its foundations could be more quickly prepared than those where there is a sub-basement and a large amount of rock excavation is required. Therefore, for erection purposes the building is divided into two unequal portions separated by a line parallel with Fifth Ave., through the light court. The first division will be completely erected and roofed while the foundations for the second division are being prepared, and that division will then be erected while the first is being finished. The steelwork weighs about 8,000 tons and will have two coats of Dixon's graphite paint.

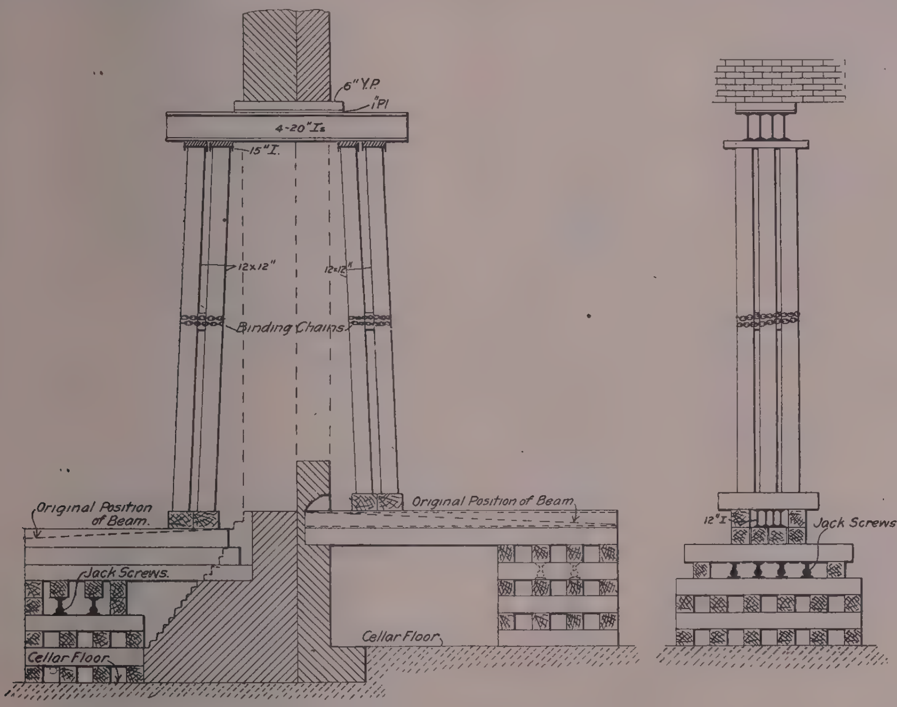
Messrs. Trowbridge & Livingstone are the architects, and Marc Eidlitz & Sons are the general contractors for this building. The contract for the steelwork and its erection was awarded to Post & McCord. The steel was fabricated at the Pencoyd plant of the American Bridge Co., of New York.

Kingsway and Aldwych, the thoroughfare recently opened in London by King Edward, cost over £6,000,000, and is particularly interesting because of its subsurface construction. The complete avenue is three-quarters of a mile long and 100 ft. wide, except for a short distance where the width is reduced to 80 ft. The roadway is 60 ft. wide, and has a double-track electric railway under its center and a pipe gallery and sewer under each side. Each sidewalk is 20 ft. wide, and under a part of it are the house vaults, connected with the pipe gallery by conduits at frequent intervals. Property worth £100,000 for taxation purposes was condemned for this work. In the construction it was necessary to excavate 300,000 cu. yd. of material, and 83,000 cu. yd. of concrete, 6,300,000 brick, 1,600,000 wood paving blocks, 13,000 sq. yd. of asphalt, 1,500 tons of granite, 15,000 tons of cement, 90,000 tons of gravel, 2,000 tons of steel and 1,300 tons of cast iron were employed.

Transferring a 2,000-Ton Wall to Columns and Girders.

The Drexel Building and the Mechanics' National Bank Building, at Nos. 31 and 33 Wall Street, New York, are respectively six and nine stories high and have adjacent side walls 3 and 2 ft. thick, in contact, making virtually a 5-ft. wall, which is built of brick in cement mortar, is self-supporting and carries the ends of the floor beams. Improvements now in progress include the extension of the Mechanics' National Bank banking room, No. 33 Wall Street, into the Drexel Building and the removal of about 50 ft. of the side walls so as to leave the new room in both buildings unobstructed except by the steel columns supporting the undisturbed upper stories of the walls.

The work consists simply of temporarily supporting the upper part of the walls, cutting out a length of 50 ft. about 20 ft. high between the first and second floors, and inserting steel girders at the second floor level to carry the upper part of the walls, eleven steel columns to support the girders, and a set of steel grillage beams under the columns to distribute their loads on the lower parts of the old walls which act as footings for the columns, the total loads being diminished rather than increased by the alterations so that there is no question of settlement to be met. The problem is thus seen to be simple, but its solution was made difficult by the limited space available to work in, the necessity of causing the least possible obstruction to the tenants of the building, and the enormous load that must be sustained without even a small displacement or distortion of the structure.



Method of Underpinning a Heavy Wall.

Temporary partitions were erected enclosing narrow working spaces on both sides of the walls and four holes were cut through the walls just above the second floor level. Through each hole a group of needle beams about 16 ft. long was inserted and wedged to bearing on yellow pine filler pieces 6 in. thick between the tops of the needles and the bottom of the wall. The ends of the needles were supported on slightly inclined timber shores with their feet seated on multiple horizontal sills in the planes of the needles. The sills were special in that they were arranged to act as levers of the second class with the fulcrum at one end, the power at the other end and the load between, much nearer the fulcrum than the power. This arrangement multiplied the effect of the power, applied by jack screws near the end of the long arm, so that it was possible to raise the shores with their great loads a small fraction of an inch much more easily than such a load could have been lifted directly. It also permitted one-half of the load to be raised from each side of the wall and so allowed more room for setting and operating the jacks, maintained equilibrium throughout the needle beam and shore system and kept the needle beams horizontal.

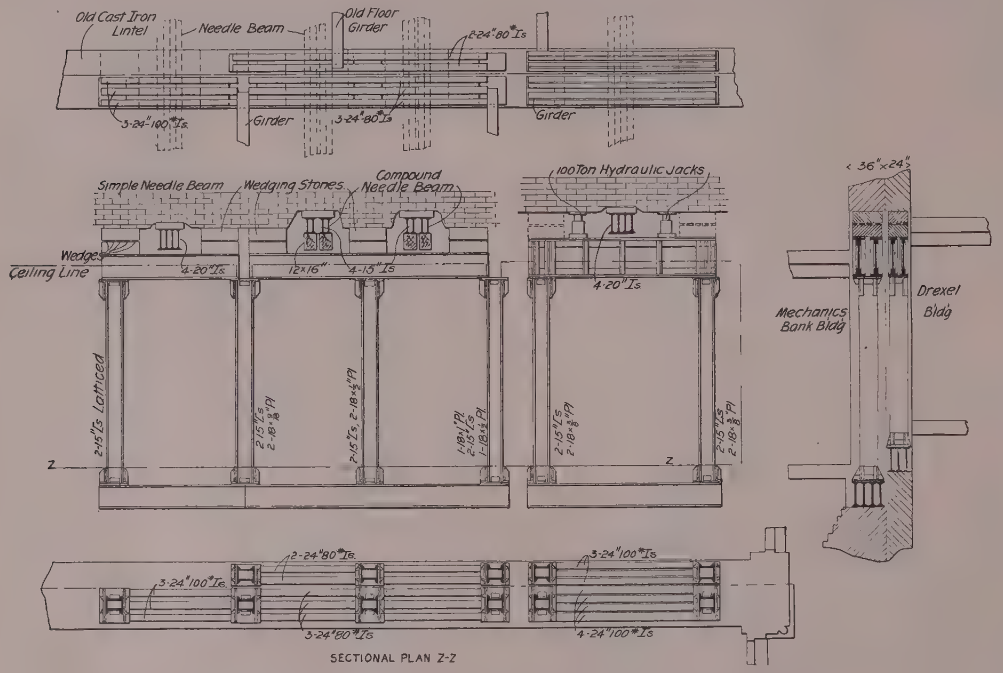
Comparatively little cutting was required to notch seats in the faces of the old footings to receive one end of each sill timber, the other end being supported on cribbing built up from the concrete cellar floor. Eight 20-ton jack screws were set under the outer ends of each set of sill timbers, sixteen to each set of needle beams, and as they were applied with a lever arm about two or three times as long as that from the shores to the fulcrum (varying on opposite sides of the wall), they could theoretically develop a combined efficiency of 800 tons, and the four sets of needle beams had a total lifting power of 3,200 tons, more than double the estimated weight of the walls carried by them. As a matter of fact, the sets of needle beams were loaded as nearly as possible to about 400 tons each and were successively jacked up to bearing, so that the full load was never applied simultaneously by jacks under all the needle beams, but the partial lifts involved more than the proportional loads due to the part of the wall directly above the needles, so that the capacity was not unduly great and there was not a large margin of excess. The outer ends of the sills were raised from 3 in. to 5 in., as indicated by the dotted lines, and the corresponding displacement of the wall was hardly noticeable; not enough to develop any cracks in the ceilings or plaster.

The needle beams were about 7 ft. apart in the clear and the brick masonry was so good that it spanned this distance without any intermediate support when the first story portion was cut out. Before the wall was removed the ends of the floor girders which it supported were wedged up on vertical shores. The walls were cut away to different levels just below the first floors of the two buildings and the upper parts of the remaining masonry were carefully leveled and sets of longitudinal 24-in. I-beams, bolted together with separators to form girders or grillages the full widths of the walls, were set on them in cement mortar beds and received on their upper flanges the pairs of columns capped with longitudinal box girders and 24-in. I-beams corresponding to the grillages except that they were all at the same level. By this arrangement the grillages, columns and wall beams form two complete and independent sets, one for each building, so that the construction is safe for either, independent of the other and would permit the removal of one building without endangering the other.

The top flanges of the wall girders were about 24 in. clear of the lower edge of the masonry above and in the space between eighteen pairs of 24x24-in. and 36x36-in. cut granite templates about 12 in. thick were set, every pair resting wholly on one set of girders or the other, and pairs of steel wedges were driven between the stones to transfer part of the wall load to the girders. Two 100-ton hydraulic jacks were also operated under the wall on the I-beams between the pairs of templates so as to raise the wall masonry slightly and develop any deflection that might appear in the girders, and the wedges were driven up hard to follow. Then the jacks were slacked off and the wall load entirely transferred to the girders and columns. Field connections were made between the floor girders and wall girders, the shores under the former and the main shores, needles, sills and cribbing were removed successively and the work was very successfully accomplished.

The two end sets of needle beams were made as shown with simple 20-in., 100-lb. I-beams, the other two sets were made with 15-in., 80-lb. I-beams seated on full-length 12x16-in. yellow pine timbers, which were considered to give a superior bearing and to afford by reason of their elasticity a desirable cushioning effect. All of the needle beams had ½-in. steel plates inserted between their top flanges and the cushion fillers under the masonry, and all of them took bearing on hardwood filler planks on top of the horizontal webs of short sections of 12-in. I-beams laid across the tops of the shores, thus distributing the loads evenly and providing bond and uniform bearing.

Messrs. Clinton & Russell are the architects for the improvements and Andrew L. Robinson & Co. are the general constractors. The work above described has been designed and executed by Miller, Daybill & Co., under the direction of Mr. Charles E. Holme, of that firm, and Mr. W. N. Sar Vant, superintendent. Post & McCord are the contractors for the new structural steel work.



Permanent Columns, Beams and Grillages and Temporary Needle Beams.

A Small Producer Gas Plant has been in operation at the plant of the Cole Mfg. Co., Chicago, Ill., for several months with very satisfactory results, according to the "Engineer." The engine is a 60-h.-p. Otto single-cylinder horizontal unit, operating on the "hit and miss" method of governing, and supplied with gas from an Otto suction producer outfit, consisting of a generator, producer and wet coke scrubber. The engine delivers about 30 h.-p. continuously, for which from 450 to 500 lb. of anthracite pea coal is consumed per 10-hour day, a consumption of considerably less than 2 lb. of coal per horse-power-hour. The producer is charged five times a day, and the ashes removed every morning, which is the only attention required in operation, except the usual oiling and attention to the producer and jacket water supply. On a recent test the engine developed half its rating continuously with a consumption of 1.6 lb. of coal per horse-power hour. On an average about 1,800 gal. of water are used per day from the city mains in the scrubber at a cost of 9 cents per thousand gallons, or about 16 cents daily.

Overheated Steel.

Among the papers read before the Iron and Steel Institute last month, one by Messrs. A. W. Richards and John E. Stead, on overheated steel, attracted much attention. It opened with a review of the opinions of those who have specially studied the subject, from which the following extracts are taken to show the importance of the author's work.

Professor Howe, in his "Metallurgy of Steel," states: "Steel which has been exposed to a very high temperature is known as 'burnt.' It is cold-short and brittle, can be forged and welded only with care, and has a low tensile strength. Its fracture is coarse and even flaky, crystalline, with brilliant facets. Steel known as 'overheated' has a coarse structure, which may be removed more or less completely by reheating or careful forging. Excessively long or strong overheating produces the structure known as 'burnt,' and the coarseness and brittleness due to burning are removed with greater difficulty and much less completely than those due to overheating, yet in the same manner and by the same expedients."

The same authority, in his work on "Iron, Steel, and Other Alloys," states: "As a palliative for burning, mechanical refining by rolling, etc., is much more effective than heat refining, as we should naturally expect. For while heat refining should be powerless to close up even the most minute cracks, the compression and kneading which accompany mechanical refining should have a powerful effect in closing cracks even of considerable size, especially if their sides have not become coated with iron oxide."

William Metcalf, in his book, "Steel: A Manual for Steel-Users," says: "A 'fiery' fracture indicates too much heat. It may be found in the best steel and in the poorest; it may be corrected by simply heating to a proper temperature. It shows that someone needs to be reprimanded for careless work." He further states: "Actual burning reveals itself in rough tears and cracks at the surface and corners of the piece. Such a piece should go to the scrap heap. Overheated steel of coarse, fiery grain has been injured, and not necessarily destroyed. Such a piece may be restored to any fineness of grain by heating to the right temperature—medium orange for the best grain—keeping it at that heat for, say, one minute for a little piece, and five to ten or fifteen minutes for a large piece. The heat should penetrate the whole mass, and it should not be allowed to run above the given color in any part, not even for a moment. It should then be allowed to cool in a dry place, without disturbance. The grain will now be fine and uniform, and the steel may be worked in the ordinary way. This simple operation is all that is necessary to restore to a fine grain any piece of steel that has been overheated, provided that the piece has not been actually burned nor ruptured." In the glossary at the end of Mr. Metcalf's book is given the following definition of overheating:

"*Overheated.*—Steel that has been heated too hot, and not quite burned; its fiery fracture exposes it. The grain of overheated steel may be restored, but restored steel is never as reliable as steel that has not been overheated. Overheating is a disintegrating operation."

A committee of the Iron and Steel Institute on the nomenclature of metallography define "overheated" as: "Applied to steel that has been heated to excess and not quite burned."

In Professor Alfred Stansfield's paper on "The Burning and Overheating of Steel," overheating is defined as "reheating to below the point of incipient fusion," and that "steel that has been merely overheated can be completely restored by heating just above its highest recalescence point and allowing to cool."

Professor Heyn, Mr. C. H. Ridsdale, and one of the present authors have shown that overheated soft steel can be, and is, completely restored by reheating to a proper temperature above the point Ac 3.

In the sixth report of the Alloys Research Committee, by Sir W. Roberts-Austen and Professor Gowland, there is evidence that overheated steel can be completely restored to good quality by reheating.

Professor Arnold, in discussing the question of restoring the good properties by reheating brittle steel, claims that it was invented in Sheffield in 1820, but that those who were best capable of judging did not call it "restoring," but "faking."

Mr. Rogers' most valuable researches on "The Fatigue of Steel"—a work which must be considered of the very highest value to engineers and metallurgists—indicates that steel with 0.27 per cent. carbon, after overheating at 1,215 deg. C. for three hours and reheating to 900 deg. C. for ten minutes and cooling in air, compared with the normal steel after annealing it at 655 deg. C. for half an hour, was restored to a higher fatigue-resisting character.

The bars as rolled, however, before annealing for a short time at 650 deg. C., stood more fatigue than the restored steel, inasmuch as it took 2,630,100 reversals at 19 tons stress to produce fracture, while the restored steel broke down with 204,350 reversals at 19 tons stress.

The experience of all steel founders has proved beyond doubt that their castings, when they leave the moulds, are very coarsely crystalline and more or less brittle, and that reheating to between 800 deg. and 900 deg. C. destroys the coarse crystallization and removes the brittleness. The physical character of overheated forged steel is identical with that of steel castings, except that the latter are liable to contain intercrystalline deposits. One would naturally expect that the same heat treatment would be followed in each class of material by the same improvement. It is well known that in the production of armor-plates the steel, during its prolonged sojourn in the cementation furnace, becomes exceedingly coarsely crystalline and brittle, and in such condition may be regarded as overheated, and that by proper heating the coarse, brittle character is completely removed, and a steel of exceptional toughness produced.

Captain H. Riall Sankey and Mr. J. Kent Smith in a recent paper show that after overheating their chromevanadium steel at 1,200 deg. C. for twelve hours and reheating to 950 deg. for half an hour the mechanical properties, according to all the tests applied, compared with those of the raw steel, were much improved.

In a paper by Messrs. Richards and Stead, published two years ago, it was shown that, provided the heating was not carried to the point of disintegration, overheated steel could be completely restored to excellent quality, and made even superior to what it was in the forged condition.

The confusion existing appears to have arisen by confounding "burnt" with "overheated" steel, and Messrs. Richards and Stead believe it will disappear if the following definitions of overheating and burning are accepted:

Overheating is heating at any point below that which produces incipient disintegration and results in the formation of large crystals. Burning is heating at or above the point at which such disintegration occurs; burnt steel is nearly always coarsely crystalline. If these definitions are accepted, the following facts should be remembered:

1. That all overheated steel is more or less coarsely crystalline.

2. That different steels apparently of the same composition vary in their susceptibility to disintegration. At a given high temperature one may be simply overheated, whilst another may be burnt and partially disintegrated.

3. That burnt steel cannot be completely restored by reheating; it can be greatly improved, but is never equal to reheated steel which has not suffered partial disintegration.

Work Done.—In the latest experiments by the authors, instead of working upon rails, they have mainly confined their work to the treatment of 1-in. square rolled bars. The tests applied were as follows:

1. Testing for maximum tenacity and elongation in a 50-ton Buckton machine having an hydraulic cylinder driven from an accumulator and belt-driven pump coupled to a motor running at a constant speed. The yield point was observed by means of a pair of calipers adjusted to suitable marks on the test-piece. The diameter of the bars, turned parallel, was 0.75 in., and the portion subjected to tension was 4 in. in length.

2. Ordinary bending tests. The pieces tested were cut from the bars and were highly polished, being of the following dimensions: Length, 100 millimetres; breadth, 6 millimetres; thickness, 3 millimetres.

3. Alternate bending of strips, having a section 6 millimetres by 3 millimetres, through an angle of 40 deg. The number of bendings backward and forward to produce fracture was recorded in each case.

4. Rotary bending, through a constant slight angle, of round pieces of the same dimensions as those used for fibre stress testing described in (5).

5. Testing by reversals of stress, by the Wöhler method, on a machine built by Messrs. Richardsons, Westgarth & Co. The machine consists of a strong steel spindle, on which are mounted three pulley wheels, giving speeds of 800, 1,200 and 2,400 revolutions per minute when driven by a suitable motor. The spindle moves in massive bearings, and each end terminates in a modified form of self-centering chuck, in which the test-pieces are securely fastened. To one end of the machine is attached a short steel bar, 10 in. long, also with suitable chuck, which is connected to the spindle by the test-piece, one end of the bar running free, and having a groove in which is loosely fitted one end of a hardened steel lever carrying the load used in testing. The other end of the machine is similarly fitted, the bar being 42 in. long, and the load is applied by means of a spring-balance, following the plan of Professor Ewing and Mr. Humfrey. A suitable counter for recording the number of revolutions is also attached.

The test-pieces were uniform in size, being 4 in. long, and turned to a diameter of ½ in., the center of each being further reduced by a semicircular groove to a diameter of exactly 1 centimeter.

Treatment.—1. Normal Steel. Bars tested in the condition as received from the rolls.

2. Overheating. The bars were packed in quartz sand in a closed firebrick tube and heated at a temperature of about 1,300 deg. Cent. for from two to three hours. The tube with contents was allowed to cool in air before opening.

3. Reheating. The overheated steels were packed in a closed fire-brick tube and heated in a muffle furnace until a temperature of 880 deg. Cent. was reached, with the exception of one series, which were heated to 950 deg. Cent. The tubes with their contents, as soon as the desired temperature was reached, were removed and allowed to cool in air before opening.

4. Annealing. The rolled bars were slowly heated in a muffle furnace to a temperature of from 850 deg. to 880 deg. Cent., with the exception of one series, which was heated to 950 deg. Cent., and was then withdrawn and allowed to cool in air.

5. Sorbitic Treatment. Portions of the rolled bars of one series were heated to 900 deg. Cent., quenched in cold water, and afterward reheated to 330 deg. Cent. for 20 minutes and allowed to cool in air.

In reviewing the results of the experiments, what appears to be most remarkable is the fact that the indications obtained by all systems of testing prove that overheating reduces the power of the steel to resist fatigue; that reheating such steel more than restores the original good qualities of the rolled bars, and that when the steel has the carbon in the sorbitic condition its power of endurance is more than doubled.

Broken Axle.—By permission of Mr. James Holden, of the Great Eastern Railway Co., the authors are able to describe experiments made to determine the effect of heat treatment on a wagon axle which broke at a flaw after being in use for twenty years. The micro-structure indicates that it had been initially slightly overheated. The analysis made by Mr. J. H. B. Jenkins, chemist to the Great Eastern Co., of a portion of steel cut from the axle was as follows: Carbon, 0.349; manganese, 0.837; silicon, 0.053; sulphur, 0.047; phosphorus, 0.085.

Portions were cut from the axle under the wheel seating, where the stresses during the life may be assumed to have been inappreciable, and from near to the central axis, where the fatigue stresses must have been at a maximum, and near to where the fracture occurred. One portion of each was reheated in a muffle furnace to 820 deg. Cent. and was cooled in air; these, with other untreated portions, were tested in a tensile testing machine at the Stratford works of the Great Eastern Railway Co. Small pieces from each portion were treated in various ways and were subjected to continuous reversals of fibre stresses.

In each case the pieces of metal reheated did not weigh more than 4 oz., the heating was rapidly effected, and as soon as the desired temperature was reached they were removed from the furnace. It is probable that a longer heating at somewhat lower temperatures would have given equally good results. As the pieces heated were small, and the cooling necessarily comparatively rapid, the treatment may be regarded as approaching that of oil-tempering on large masses.

In reviewing the data received from Mr. Holden about this axle, together with the information obtained by their own testing, the following observations were made by the authors:

RESULTS OF TESTS OF OVERHEATED, REHEATED AND ANNEALED STEEL.

A, average bends through angle of 40 deg. B, total revolutions at 1,200 r.p.m. and altern't'g fibre stress, C to cause fracture. D, total revolutions at 1,200 r.p.m. at an angle of 6 deg. to cause fracture.

Carbon.	Treatment.	Yield point tons per sq. in.	Ultimate St. tons per sq. in.	A	B	C tons.	D
0.06	Normal	16.05	24.40	48	13,560	25	3500
0.06	Overheated	14.75	23.80	36	9,760	25	2590
0.06	Reheated	15.85	24.20	53	14,500	25	3730
0.06	Annealed	15.65	23.60	52	14,200	25	2680
0.48	Normal	27.20	45.80	115	83,550	28	3940
0.48	Overheated	22.00	48.30	51	38.660	28	2040
0.48	Reheated	27.00	45.80	116	111,500	28	5300
0.48	Annealed	27.40	46.90	115	103,130	28	5120
0.44	Normal	21.70	40.20	117	1,432,500	25	3660
0.44	Overheated	20.60	41.30	72	844,950	25	2207
0.44	Reheated	22.00	40.20	132	2,080,440	25	5390
0.44	Annealed	21.30	39.90	129	1,971,000	25	5215
0.44	Sorbitic	43.40	55.10	263	3,517,200	25	9280

NOTE.—It is possible that typographical errors in one of the original tables in the paper have introduced errors in the results of the tensile tests of the overheated, reheated and annealed 0.48 carbon steel.

1. The axle stood 20 years before it finally broke. During this period it had traveled probably 300,000 miles, and had been subjected to 200,000,000 reversals of stress.

2. The flaw which initiated the fracture appears to have been a deep stamp mark.

3. The weakness produced initially by this deep impression eventually led to a fatigue fracture which traveled through a portion of the section. Sudden or granular fracture followed through the remaining part of the mass.

4. The inference is that had there been no such excessively deep stamp impression the axle could not have failed. In the experience of one of the authors, this weakness and eventual fracture in axles is not by any means uncommon as the result of deep stamp indentations. Such indentations are the exact equivalent of flaws, although deliberately produced instead of being accidental.

5. According to the fibre stress testing, the normal steel of rather coarse crystalline material is relatively weak, but for all that it is good material and calculated to be quite strong enough to stand all the normal working stresses.

6. Proper heat treatment very greatly increases the fatigue-resisting properties of the steel.

7. Ordinary tensile tests which do not show the yield points fail to give a hint as to the relative value of steels in their power to resist fatigue.

The paper was accompanied by illustrations and a number of tables which are summarized in the accompanying table.

LARGE GAS ENGINE OPERATION has a chief difficulty in the high flame temperatures encountered in the cylinders. Rapid cooling of the charge is necessary to protect the working parts, and many different complicated systems of water cooling have been introduced in Continental practice for all parts of the valves and their casings, and even for the pistons and piston rods of the double-acting engines, except in the valveless engines, such as the Oechelhaeuser type, which have advantages in this respect. There seems to be a tendency, however, toward the use of several smaller cylinders rather than one or two much larger ones, which renders this burdensome complication unnecessary. Dugald Clerk has, according to a paper by E. A. Dowson before the Birmingham Association of Mechanical Engineers, introduced a system of admitting to the cylinder, after the explosive charge has been drawn in, an inert diluent, such as air, or cooled exhaust gases, which does not mix with the charge to any serious extent; the charge is compressed and ignited in the usual way, and the presence of the diluent serves to reduce the flame temperature to a remarkable extent. The result is a cool working engine, developing a greater power for a given size of cylinder, and yielding a higher thermal efficiency. Still another scheme involves the introduction of a few drops of water sprayed into the cylinder during the suction stroke which keeps the temperature down.

Sinking Machinery Foundations in Quicksand Without Excavation.

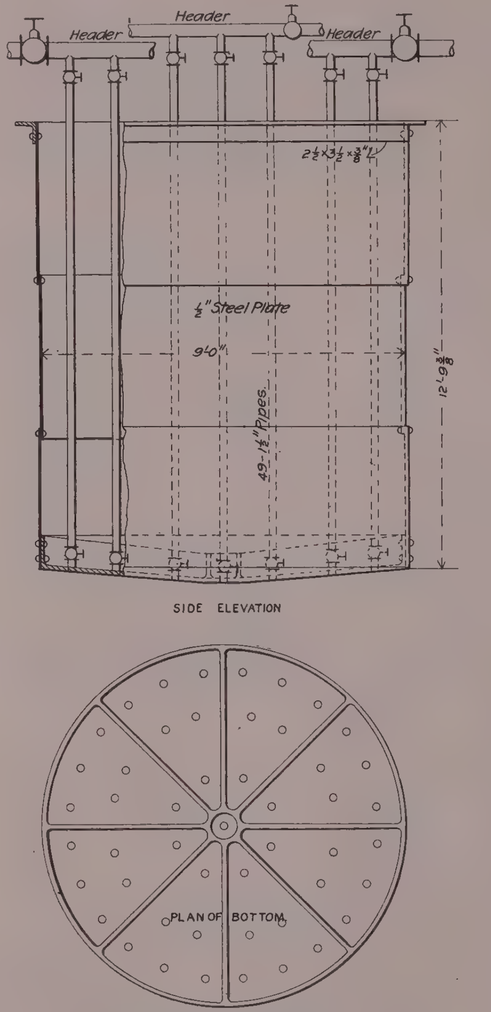
A 60-ft. boring mill of General Electric make and design was recently installed in the machine shop, building 16, of the General Electric Co.'s plant at Schenectady, after the shop was completed and all the principal machine tools were in operation. The mill is located in the center aisle of the building so close to the main columns that its footings intersect the footings of two columns which on this account were separated twice as far apart as the others in the same row, and therefore carry loads twice as heavy as the normal from the roof, upper floor and runways of two 50-ton traveling cranes. The mill and its foundation weighs about 400 tons. The circular foundation has a diameter of 49 ft. and wide radial extensions of 8 ft. on all sides, making the extreme diameter 65 ft.

The distance from the center of boring mill foundation to the center of the nearest column foundations is 28 ft., and their footings are located on quicksand, on which they impose a maximum pressure of about one ton per sq. ft. There was located 40 ft. from the center of this boring mill a foundation for testing 7,500-kw. vertical generators, which weighed about 400,000 lb. This machine was being tested while the foundation was in progress.

In the center of the boring mill foundation there is a cylindrical steel-lined well 9 ft. in diameter, with its bottom about 22 ft. below the floor line and 12 ft. below the water level. The soil consists of quicksand to about 1 ft. below ground water level, 3 ft. of dry clay and loam and 7 ft. of fill. It was evident that any ordinary method of sinking the well would endanger all the adjacent foundations and threaten their undermining or settlement. A very ingenious and novel method was therefore devised and successfully carried out by Mr. W. A. Pearson, engineer in charge of building construction for the General Electric Company, Schenectady, N. Y., by which the well was sunk in place without displacing any of the adjacent soil, without disturbing the equilibrium of the soft material, without causing any subterranean flow from under the adjacent footings, and without any interruption to the regular machine shop operations. An open pit was dug with pick and shovel to the quicksand in the center of the foundation and in it was set a vertical steel cylinder 9 ft. in diameter and nearly 13 ft. high with an open top. The bottom was closed by a ribbed and flange casting, slightly convex downward. Through the bottom were 44 1½-in. holes symmetrically arranged in the center and in three concentric circles. Each hole was tapped for a vertical pipe extending about 12 ft. above the top of the cylinder, to a convenient height above the shop floor. Each pipe was fitted with a gate valve close to each end, and above the upper valve was connected to a header or distributing main 3 in. in diameter, through which an abundant supply of water at 80 lb. pressure was provided from the regular shop service. The headers were arranged in five sections, each commanded by a single main valve and controlling a portion of the vertical pipes, independent of their top and bottom individual valves. One section comprised all of the nine pipes in the inner circle; each of the other sections included the twelve pipes in the outer two circles between alternate radial ribs of the bottom casting.

When all was in readiness all the valves in the vertical pipes were opened and all those to the headers were closed, and the cylinder was loaded heavily with pig lead packed in between the vertical pipes. On Sunday morning when there was no regular shop work in progress there, Mr. Pearson took possession of the shop with a force of men and personally directed the hazardous sinking of the cylinder. A large number of 12x18-in. parallel castings about 10 ft. long were provided to additionally load the cylinder and were bolted across the top to overhang as far as possible, cantilevering as much as 8 ft. in some cases. The two 50-ton overhead traveling cranes were prepared for immedate service, one on either side of the cylinder, the header valves were all opened and water pressure was admitted to scour out under the bottom of the cylinder. This washed the quicksand away and the muddy water rose to the surface on all sides of the cylinder, and allowed it to sink without disturbing the equilibrium of the adjacent ground pressure.

When the cylinder had sunk about 8 ft. it suddenly commenced to tip and quickly became about 30° out of plumb. The header valves for controlling the scouring pipes on the low side were immediately closed and both cranes commenced removing as fast as possible the cast-iron weights from the low side and placing them on the high side of the cylinder, where they also put additional pieces, which with the cantilever arrangement produced a large moment opposed to the tipping. The tipping was stopped in two or three minutes, and by care in loading and scouring the cylinder was restored to verticality before its sinking was completed and was finally brought to rest with its center only about 2½ in. from the required position, thus securing all necessary accuracy. All the valves were closed and the pipes disconnected just above the lower valves, which were left in vertical position and embedded in the layer of concrete with which the bottom of the cylinder was filled.



Pipes and Valves for Sinking Steel Shell.

The space around the outer side of the cylinder was filled up to water level with concrete in dry bags. The rest of the foundation area had been excavated about a foot below water level, and in it a 2-ft. layer of concrete was carried from the cylinder outward until the whole footing was covered and afterward the remainder of the foundation was built in the usual way. The sinking of the cylinder was commenced about 8.00 a.m. and was completed in about five hours, and the foundation was built without interrupting shop work or causing the slightest settlement in the adjacent foundations, some of which, supporting heavy and accurate machinery, would have quickly indicated any displacement.

Some Peculiarities of Cement.

A paper read before the Association of American Portland Cement Manufacturers by W. A. Aiken.

At the International Engineering Congress in St. Louis last year I drew a distinction between the inspection and testing of cement when saying, "the more one knows of the process of manufacture, the more is it evident that much commercial cement, not equal to the best, will pass the physical requirements of most specifications." As a matter of growing interest and to emphasize this distinction, I have thought to outline the methods carried out by the Department of Inspection of Materials under the Board of Rapid Transit Railroad Commissioners of the City of New York.

It was assumed from the start that the manufacturing contractor and ourselves were both working with the same object, to deliver on the work only cement "equal to the best American Portland," as called for by our specifications; consequently, there should be nothing to be concealed from the department's inspectors, who, it was similarly assumed, could have no ulterior object in view beyond learning as thoroughly as possible every detail of the material's manufacture in order to fix, if possible, the cause for any defect if found later on in the finished product. The chemist of the department early visited the contractor's cement plant as well as several others to discuss methods of analysis with their representatives in chemical work, with the object of co-ordinating results as closely as possible. The location of our testing laboratory was from the start determined on as most properly identical with the point of manufacture, with the twofold object, to obtain a uniform product, a most important desideratum in the case of such an extended line of work as that of our subway, and, assuming this to be furnished from the mills, to assure as far as possible results of tests showing this, to have all testing done by a single set of operators. The fact of uniformity in the product before testing was to be established by continuous sampling of each lot submitted.

The product as manufactured is ground into bins of a capacity approximating 1,500 barrels. During the operation of grinding, sampling is done at intervals night and day, depending upon the rapidity of output, and on occasions the time so consumed, even apart from the appearance of the clinker or tests has served to call particular attention to the resulting finished material. Ten complete samples, each to be tested separately for periods up to 28 days both in neat paste and 2:1 sand mortars, are taken from each lot of cement; each of these ten samples being composed of a number of individual samples either taken at one time over different parts of the surface of the bin's contents, representative of a layer, or at different times, representing the finished product delivered into the bin in a certain time. Later a mix of all samples taken is tested similarly in neat paste and 2:1 sand mortar at all periods up to five years. The average results of thousands of such comparative tests do not show at any period a greater variation than 2½ per cent., and in only one single instance exceeds 5 lb. difference.

It is this character of work, only obtainable by testing always done under as nearly normal and identical conditions by one set of testers working by rule, that permits the conclusions we feel satisfied in deducing. The samples as taken are always stored under similar conditions till tempering and moulding are undertaken, which occur upon the filling of a bin. The percentage of gauge water is determined regularly every day experimentally, normal consistency being sought for always by the experience of the tester, one man always making up the neat briquettes, just as another man always makes up the sand briquettes. Air temperature is pretty fairly controlled, as the laboratory is a thick-walled stone building, cool in summer and steam heated in winter; this air temperature will average about 70° Fahr. Temperature of gauge water is kept equal for each lot of cement, both for neat and sand tests. Fineness on 50, 100 and 200 mesh sieves and specific gravity are regularly determined, and air and cold water pats as well as boiling test pats, and briquettes are always made up from the general mix of all samples, the same material from which the five-year series of long-time briquettes are made, though any one or all of the ten-layer samples of any lot may be tested individually to determine how the material is complying in detail with the specification requirements of fineness, specific gravity and setting time.

The radical failure of one of these samples in any particular has been cause for rejection, even though the general mix of all samples is satisfactory, it being assumed that the laboratory refinement in mixing is not surely obtainable in bagging out the product.

Boiling tests as specified are made both at the time the regular briquettes are made up, and if failing then to prove satisfactory, are duplicated at the end of 28 days when final action is taken on each lot of cement. These second boiling tests are made up from a sample taken from the interior of the stored cement as well as from a quantity bagged as the original samples were taken. Everything being satisfactory at this time except compliance with the boiling tests, such material has occasionally been forwarded in bags, unsealed, and at a later date reboiled. Such product has never failed to finally be accepted. Neat tempering is by the trowel; gang moulds of nine are used, three briquettes for each period. The cement and sand are first mixed dry in a tin basin, water added and material thoroughly tempered with a knife. While the neat material is put into the moulds without any regard to its selection, regularity is always maintained in taking all briquettes, neat and sand, from the gang moulds, the first, fourth and seventh always being used for 24-hour tests; the second, fifth and eighth for 7-day tests, and the third, sixth and ninth for 28-day tests, this to minimize the personal equation of the tester. All 24-hour neat tests and 7-day and 28-day sand tests are broken on a Fairbanks shot machine; later period tests are aimed to be broken on a Riehle beam machine. I desire to record here my conviction that the ideal conditions for long-time tests are certainly not obtained ordinarily through tension tests, unless, as shown at the last meeting of the American Society for Testing Materials, it is through a great number of sand tests, only obtainable from the records of large work similar to that directed by myself, but it is undeniable that the results then shown as obtained in our laboratory are so uniform for the different classes of cements tabulated, that we see no reason for changing our specifications. I however hope, in any new construction to be shortly undertaken, to install a machine for compression tests, when, for any equally large number of tests as we now have for tension, if obtained under compression, less question as to the finality of deductions can be raised.

Apart from the daily routine work of our laboratory we are continually engaged on much special work, all with the object of learning more about the material in hand. Numerous tests have been made from cement prepared by ourselves from normally proportioned composition, the resulting clinker being admittedly underburned as well as overburned, from cement which by analysis and physical characteristics was known to be insufficiently limed, if not otherwise badly proportioned, this both underburned and overburned.

The questions of gauge-water percentage and its influence on the percentage of gain in strength in a given time called for under our specifications, the use of the Vicat needle for determining normal consistency compared with our regular practice, have been repeatedly studied. Comparative tests of blended cements from rotary and dome kiln clinker, rotary clinker and natural burned rock, as well as dome kiln clinker and natural burned rock have been made many times. In addition, much time each winter is devoted to the making of frost tests and the effect of substituting brine for gauging instead of clear water; many comparative tests of identical cement made up from standard quartz-sand and numerous samples of material such as used on the work, are of record. All sand used on our construction is passed on by this department and we have instituted an empirical ruling to determine the satisfactory character of such material.

All this goes to mark what I consider the distinction between inspection and testing, not obtainable except where the laboratory is located at the point of manufacture and the advantages of which serve to avoid the conditions so often resulting in the fact that such commercial cement will meet ordinary testing requirement, which, if properly inspected, would not be accepted.

All accepted cement is shipped in sealed bags, impressed with our monogram and month of acceptance, thus allowing the identification of the material on the work after delivery if necessary.

The analyses in Table I are submitted for comparison with the accompanying record of long-time tests of several classes of cement submitted to the Department of Inspection of Material of the Board of Rapid Transit Railroad Commissioners of the City of New York.

TABLE I. — CHEMICAL COMPOSITION, AVERAGE TENSILE STRENGTH AND LIME FACTOR OF SIX CLASSES OF CEMENT.

Class	1	2	3	4	5	6
SiO_2	20.92	21.00	21.09	20.76	20.05	20.52
Al_2O_3	8.53	8.70	8.51	8.46	8.10	8.62
Fe_2O_3	2.78	2.86	2.78	2.76	2.80	2.81
CaO	63.05	62.78	62.86	63.28	68.18	63.21
MgO	2.38	2.28	2.37	2.42	2.45	2.35
Neat Portland—						
24 h.	300	285	294	309	337	327
7 d.	689	566	657	759	857	757
28 d.	799	707	768	856	907	792
3 m.	799	751	790	841	863	812
6 m.	799	765	789	822	831	804
1 yr.	805	767	807	825	844	807
2 yr.	791	778	781	806	688	767
3 yr.	759	740	755	774	...	722
1:2 *Mortar—*						
7 d.	404	356	392	429	460	434
28 d.	525	497	523	537	518	519
3 m.	568	591	578	553	474	538
6 m.	549	566	567	525	409	511
1 yr.	552	540	551	571	384	508
2 yr.	523	512	520	407	...	505
3 yr.	492	515	500	467	...	520
Factor	2.60	2.57	2.58	2.64	2.80	2.66

Class I represents the average results on all accepted cement on Rapid Transit work. Class 2 represents average results on all our accepted cement pulling neat at 7 days less than 600 lb.; class 3, the average results on all accepted cement pulling neat at 7 days between 600 and 700 lb.; class 4, the average results on all accepted cement pulling neat at 7 days over 700 lb. This is done at this time to emphasize the value to us of the 15 per cent. gain clause in our specifications in connection with low test strength at early periods, the cement of class 2 (our lowest pulling material) maintaining a gradual increase in neat results to a later period than any higher pulling cement. While its sand results, as is customary I believe with all such rich mixtures, show loss after 3 months time, still at the latest period this is better than either of the other classes of accepted cement and stronger then than it was at 28-day periods, undoubtedly a desirable feature. Class 5, which represents too high pulling cement, falls away in both neat and sand results at 3 months, and shows up particularly badly at 3 years in comparison with its 28-day results. Class 6, which represents cement rejected for failure to approximate our specification gain at 28 days, holds up in strength both in neat and sand till after 3 months, and while not as strong neat at 3 years as 28 days, its percentage of loss at this period compares favorably with our accepted cement pulling over 700 lb. at 7 days, while its sand showing is some better than this highest pulling accepted material and as good at last period as any accepted cement though fluctuating markedly at intermediate record periods, at none of which is it as strong as the sand mixtures of the lowest pulling cement. This amount of rejected cement was relatively so small that no point can be made of its comparative good showing at last period, other than to emphasize the desirability of low pulling early stage material, and to suggest the possibility of limiting the early strength of the product irrespective of any special gain between such periods.

In this connection I wish to say that in all our studies of cement with particular reference to the correctness of our specification requirement of a minimum gain, I have very constantly compared our material as classed above by Mr. Newberry's lime factor formula, since first reading his paper presented to the Society of Chemical Industry in 1897, checking probable physical results from analyses made before 7-day test results were available, and Table II shows our experience, classified in reference to the lime factors of the finished material, with the analyses referred to the same factor.

TABLE II.—CHEMICAL COMPOSITION AND TENSILE STRENGTH OF CEMENTS OF TABLE I, ARRANGED BY LIME FACTORS.

Factor.	—2.50	2.50/2.55	2.56/2.60	2.61/2.70	2.71/2.80	2.80+
SiO_2	22.07	21.40	21.06	20.58	20.24	19.70
Al_2O_3	8.61	8.67	8.65	8.56	8.13	8.03
Fe_2O_3	2.57	2.70	2.82	2.84	2.88	2.94
CaO	62.41	62.58	62.93	63.14	63.66	64.06
MgO	2.24	2.34	2.37	2.42	2.43	2.54
SO_3	2.00	2.00	1.84	1.58	1.48	1.56
Neat Portland, Accepted.						
24 hr.	288	293	303	308	314	308
7 d.	650	677	680	702	729	741
28 d.	762	793	783	812	832	845
3 m.	801	805	786	810	950	814
6 m.	793	810	790	804	797	817
1 yr.	793	810	814	817	809	789
2 yr.	773	789	779	781	810	810
3 yr.	770	805	731	738	...	...
1:2 *Mortar, Accepted.*						
7 d.	376	402	410	408	427	420
28 d.	514	525	534	528	531	521
3 m.	577	576	590	570	548	536
6 m.	576	565	563	542	514	472
1 yr.	562	550	549	503	486	471
2 yr.	523	512	511	471	430	306
3 yr.	488	470	505	464	...	...

An interesting comparison of the tensile strengths, as shown in Tables I, where the division into classes is strictly upon the physical result basis and those in Tables II where the division is by lime factors, is found when the percentage of total accepted material pulling neat less than 600 lb. at 7 days is shown to be almost identical with the lime factor material below 2.50. Similarly the next class of material of Table I, that pulling neat between 600 and 700 lb. at 7 days corresponds in percentage of whole very closely with the lime factor material between 2.50 and 2.60, while the highest strength accepted material, that pulling neat over 700 lb. at 7 days agrees with the lime factor material between 2.60 and 2.80. While the acceptance of material on our work is mainly controlled by the gain clause of our specifications, other requirements being normal, it is to be noted that material showing a lime factor above 2.70, while meeting this, is not in my opinion as satisfactory a product as the lower lime factor material, as confirmed by the physical results both in neat and sand mixes.

These results prove, I think, that our gain specification clause, while an innovation at the time, has come to stay. Further, a selection of a lot of "ideal" parcels of our accepted cement showing an average gain neat between 7 days and 28 days of 15.9 per cent., and in sand for the same period 30.2 per cent., giving a lime factor of 2.54, shows still more strongly than do the records, both physical and chemical, of class 2 (our lowest pulling accepted cement), the value of this character of product for a final showing, and approximates what I have always desired for our Rapid Transit work, a cement pulling neat at 7 days close to 600 lb. with a minimum gain of 15 per cent. at 28 days, and pulling close to 400 lb. in 2:1 sand mortar at 7 days with a minimum gain of 25 per cent. at 28 days. The analysis of such a cement normally burned and properly prepared therefor in our Lehigh Valley section, I think, should show as follows: Minimum, SiO_2, 21.00; maximum, Al_2O_3, 9.00; maximum, Fe_2O_3, 3.25; CaO, 62.5 to 63.25; maximum, MgO, 3.00.

I am satisfied I am on the right track so far, in our requirement of a minimum gain: whether this should be positively stated as our Rapid Transit specifications have done, or the percentage ignored, fixing a maximum limit at 7 days instead, may be a matter of opinion. What I am after is to get rid of material of too great "chemical activity." Whether the notorious 15 per cent. requirement is the best way to do this may be questioned by others: we are content therewith till something better is offered.

Book Notes.

The "Report of the Test of Metals" and other materials made at the Watertown Arsenal during the year ending June 30, 1904, is full of valuable information to civil and mechanical engineers. During this period 129 tests were made of material produced at the Arsenal and supplied from outside sources for working up there, and bars have been tested for use in calibrating other testing machines with those at Watertown. The 2,231 tests made for general ordnance purposes included an examination of gun forgings and developed the fact that streaks were present in them. Proof stresses were applied to piston rods and retraction ropes, and investigations were made of helical springs, copper cylinders for pressure gauges and in determining powder pressures, the wheels and axles of mountain guns and gun wire. The series of tests of metal from a carbon steel ingot of the grade used in gun forgings have been continued by forging the test specimens at different temperatures and subjecting some of them to heat treatment afterward. There have also been retests of wrought iron, following a period of rest of 22 years since the original experiments were made. The tensile properties characteristic of the earlier overstraining loads still remain in the iron at the present time. The feature of the book which will attract most attention, however, is the record of tests of mortar, concrete and brick. Columns 1 ft. square and 8 ft. long, made of concrete, with and without reinforcement, and of brickwork have been numerous and so well planned that a large amount of useful information has been obtained. Tests of wood posts have been made and the experiments on the endurance of steel bars subjected to alternating stresses have been continued. Taking the volume as a whole it may be said to be a veritable mine of information concerning the properties of the materials of engineering.

Two small handbooks written for the use of foremen engaged on building work have been issued at 50 cents each by the Industrial Publication Co., New York. The first of these is on "Scaffolding" and brings together considerable information concerning ancient and modern methods of putting up staging in Europe and Great Britain. There is some reference to American methods but they are generally stated incorrectly. As an explanation in simple terms of an old subject full of interesting facts the book has some merit. The second of these manuals, on "Concrete," contains numerous statements concerning British opinions regarding concrete making which are decidedly different from those held in America. One important reason for some of these differences is probably the fact that until recently British cement was made solely in dome kilns and was coarse in grain, thus requiring considerable seasoning, while American rotary kiln cement, finely ground, does not require any such period of storage to be ready for use. The author covers the field of concrete preparation and application in a way that will doubtless be of considerable interest to workmen, although without sufficient accuracy or detail to be of engineering value.

The British Fire Prevention Committee has published three more "red books" giving the results of tests made at its experimental station. The first describes experiments with three vertical openings filled in with wired glass and subjected to a temperature of at least 1,500° for three-quarters of an hour, followed by the application of water for two minutes. Immediately on starting up the heat the glass cracked, particularly around the edges, and on the application of water a number of small holes appeared; the fire did not pass through the glass, however. The second report covers tests of four-wired glass partitions made in the same way, which gave similar results. The third report describes a test of a 2½-in. partition of porous hollow terra-cotta tiles made by the National Fire Proofing Co. This partition was exposed for 2½ hours to a gradually rising temperature which eventually reached nearly to 2,000° Fahr. When this heating was completed a stream of water was played on the fire side of the partition for two minutes. Neither fire, smoke nor water passed through the partition, which remained in position at the conclusion of the test. These reports are sold at 2/6 by the Committee at its office, 1 Waterloo Place, London.

The Steam Engine and Other Steam Motors. Vol. 1, The Thermodynamics and Other Mechanics of the Engine. By R. C. H. Heck, London, Kegan Paul, Trench, Trübner & Co.

Prof. Heck's book will be mainly interesting to those engineers who wish to understand the principles on which steam engines work, for it contains practically nothing about detailed design. It opens with a discussion of the nature of hot gases and steam, and the thermodynamic principles of piston engines. In discussing superheated steam he adopts Zeuner's formula in which a constant specific heat is assumed for constant pressure expansion, but an appendix gives the later and probably more accurate opinion of this relation. The portion of the book devoted to adiabatic expansion is very thorough, and the divergence of experimental data from Zeuner's exponential adiabatic law is fully treated. He then passes to an interesting discussion of the ideal limits of steam engine efficiency. The effects of clearance and compression are considered at considerable length, and the following chapter on cylinder condensation contains a formula that seems to agree very well with experiments. This section of the book is followed by one on the use of the steam jacket and on engine economy. The chapter on the steam jet is of unusual interest. Adiabatic expansion is assumed, and, contrary to German and French custom, the losses of energy from friction, eddies and heat radiation are neglected. The author has spent much trouble in determining the adiabatic curves of wet and dry steam, and in this chapter the importance of his results are made very plain. While some of his statements concerning jets may be criticised, the chapter as a whole is unquestionably one of the best ever written on this complex subject, which he makes specially clear by the aid of numerous tables and diagrams. The second portion of the book relates to the acceleration of reciprocating, oscillating and rotating masses, flywheel action, balancing, and similar subjects. Particular reference should be made to three novel diagrams for the displacement, velocity and acceleration of the piston, and to the discussion of counterbalancing. The book as a whole is an excellent example of the scientific handling of a practical subject.

Handbook of Cost Data for Contractors and Engineers. By Halbert P. Gillette. New York, Myron C. Clark, 16mo, 622 pp., $4.00.

The average engineer and contractor is inclined to look upon records of the cost of work as of little value, because they are not sufficiently definite to give an idea of what the figures really mean. The statement that a concrete wall was built for a certain sum per cubic yard is of trifling value, for instance, unless the cost of each class of materials used, the number of days' work performed, the expense for plant, the rate of wages and other expenses are itemized. Such itemized information is not easily obtained, and the fact that the author has spent twelve years in obtaining the data in this book is a pretty good indication of the care with which his task has been performed. Not only is the book unique in its scope, but it is also unusual in the very frank way in which the author himself discusses many of the figures he gives. In many places these figures are not sufficiently complete to be of more than very general value, but the author is careful to point out this fact repeatedly. Everywhere the book bears the mark of being written as a pleasure and not a task, and the author's manifest deep interest in his subject has its reward in the decidedly readable character of his data. Moreover he gives a large amount of information about the way in which different classes of construction have been actually carried on, thus adding to the value of the statistics of cost. These statistics are, in many cases, the figures of actual expenses, and not the prices paid for the completed undertakings, which, it is hardly necessary to say, are often considerably different.

The first section of the book is made up of a series of suggestions concerning the best methods of keeping accounts on construction work. The author strongly recommends the unit system, which is rapidly coming to be recognized as the best for many purposes. It not only keeps a daily record of progress, from which the cost can be quickly estimated, but it also affords information on which to base improvements. When it is thoroughly worked out no laborer can shirk more than a day or so without the fact becoming known, and any part of the plant that needs improvement can be detected. The great objection to it is the reluctance of foremen to keep written records, but this can be overcome by many ingenious methods suggested in the book. The author also gives 26 pages of hints to young contractors on all manner of subjects.

The cost data forming most of the book's contents are classified under earth excavation, rock excavation and crushing, roads and streets, stone masonry, concrete masonry, water-works, sewers and drains, piling and timber work, buildings, steam and electric railways, bridge erection and painting, surveying and miscellaneous. Under some of these heads the data are few and of little value; for example, the information concerning the cost of bridge erection does not amount to much. This is not surprising, however, in view of the fact that only a few people have such information and wild horses cannot drag it from them. On most classes of work, which an engineer must estimate, however, the data are comprehensive.

The book as a whole is one that deserves much praise, and young engineers will find it particularly helpful. This journal has so often urged the importance of studying costs that it is glad to be able to refer its readers to such a good book on the subject.

Der Eisenbau. Handbuch für den Brückenbauer und den Eisenkonstrukteur. By Luigi Vianello. Munich, B. Oldenbourg; cloth, 8vo, 707 pp., 17.50 marks.

This volume differs completely from the books on steelwork hitherto published, occupying a middle ground between the handbooks issued by rolling mills and the treatises on the computation of stresses in framed structures. The author disavows any attempt to produce a book for purposes of instruction, his aim being to bring together only such information as will be useful in the drafting office. On the other hand, it is not a mere collection of formulas and tables, but summarizes the scientific principles on which good steel design is based. On this account some elementary principles are given for reference in starting new lines of investigation, for the author very properly acknowledges that the best of engineers sometimes find it profitable to run over such basic principles when a novel problem is presented to them. In presenting these and other subjects, however, the author aims at conciseness, for "in designing everything must be done as quickly as possible," and a study of elaborate treatises takes more time than can be afforded in the office.

The first chapter is a collection of mathematical tables and rules, including certain methods for solving equations which ought to be translated for American handbooks. The second chapter contains a review of those principles of mechanics which are employed by the bridge designer, and the third chapter is a similar review of the principles of statics, including the elements of the theory of influence lines. In the fourth chapter, the computation of the stresses in statically determinate trusses of many types is explained, both analytical and graphical methods being discussed. The fifth chapter is a summary of the methods used in computing the stresses in domes, gas holders and other frame works not in one plane. The sixth chapter is one that deserves special attention, for it is a concise explanation of the methods of computing stresses in statically indeterminate frames, a subject in which German technical literature is particularly rich. The methods of displacement and influence lines are here applied to a great variety of problems, and other methods are also used. The author points out that some engineers prefer one method and other engineers prefer another, so that completeness is only possible by giving all that have any practical value. The seventh chapter is devoted to masonry, which is here included because bridge engineers have to design abutments, piers and masonry arches for approaches. The eighth chapter gives the rules and methods adopted in detailing steelwork in German shops, and the ninth chapter gives a summary of the official regulations concerning bridges, many suggestions of a general nature, and an outline of the methods followed in designing a railway bridge, a highway bridge, a roof and a shop building. The volume closes with many tables corresponding to those found in rolling-mill handbooks.

A word of praise is due to the publisher for the excellent way in which the book is printed and illustrated. It is intended for everyday use in the office, and both type and cuts are large and clear, so that the overstrained eyes of the draftsmen will not have a needless tax put on them in referring to its pages. Just why American publishers consider that such books should be printed in microscopic type is hard to understand, for the bulk of them, even in this minute type, makes them too large for the pocket, and anyway, very few of those who use them ever employ them outside the office, where greater legibility is highly desirable.

Letters to the Editor.

The Design of a Reinforced Concrete Arch Without Hinges.

Sir: There is no class of structure to the construction of which reinforced concrete can be applied more satisfactorily than to bridges of moderate span. Such a bridge, well designed and faithfully executed, is practically indestructible; the cost of maintenance is almost nil, while its artistic possibilities exceed those of any other type. It is not surprising, therefore, that the concrete arch bridge is rapidly gaining in popularity. There is consequently a growing demand for a ready method of approximate design by which the necessary thickness of the arch ring and the required amount of steel reinforcement for any given span and loading may be determined. It will not require an extended study of the details of concrete arches executed in the past year or two to convince one that there is but little unanimity among engineers upon these points, and, admitting that some of these structures are too light for the purpose for which they were designed, there can be no question but some are much more massive than necessary. In other words, the present methods of design as interpreted by different engineers lead to widely varying results.

As we are dealing with an indeterminate proposition, the results, by whatever methods obtained, are but approximations of the real stresses acting upon the arch ring, and a change in temperature or a slight movement of the abutments may reverse or replace them with greater or very different stresses. For these reasons it would seem that design by an empirical formula is not only justifiable, but quite as apt to give satisfactory results as the more laborious methods. Of masonry arches, Rankine says: "The best course to pursue is to assume a depth of keystone according to an empirical rule founded on dimensions of good existing examples of bridges." Accordingly, the writer has devised the following equation, based upon a study of all available data upon the subject and his own experience in designing arches for a great variety of conditions. He believes it a safe guide for all ordinary conditions of span and load:

$$C = \sqrt{S} + 0.1\,S + 0.005\,L + 0.0025\,D$$

Where C = thickness of arch ring at the crown in inches, S = clear span in feet, L = live load per square foot, uniformly distributed, and D = weight of fill over the crown per square foot.

For example, it is desired to find the required thickness of the crown of an arch to span 60 ft., live load 200 lb. per square foot or a 15-ton road roller. The fill over the crown to be 2 ft. thick. Crown thickness $= 7.7 + 6 + 1 + 0.55 = 15.2$ in.

For railroad bridges add 50 per cent. to the equivalent live load for impact.

Having determined C, lay out the arch, giving such rise and waterway as are required by local conditions. The arch ring at the quarter points should have a depth of from 1¼ C to 1½ C, depending upon the curve of the intrados. The rise of the arch is preferably from one-tenth to one-eighth the span, but will usually be governed by local conditions.

As a heavy moving load in crossing the bridge will probably reverse the stresses in the arch ring, the steel reinforcement should be placed in two layers, one near the intrados, the other near the extrados and made continuous over the entire span. The amount in each layer is made equal to four-tenths of one per cent. of the area of the cross-section of the arch at the crown; or a total area of steel in the arch equal to eight-tenths of one per cent. of the area of said cross-section. The shear members should be rigidly attached to the longitudinal bars and extend from one layer of steel to the other.

Central piers should have a mimimum thickness of one-twelfth the clear span. A slight batter adds to their appearance and stability. The abutments must be massive and of sufficient size to resist all overturning moments. When conditions are favorable they may be made of the "hollow" type and properly reinforced with steel to take the heavy strains to which they are subject, thus effecting a saving in the amount of concrete required. As it is absolutely essential, however, to secure immovable foundations for the bridge, too much economy in the footings is ill advised.

Detroit, Oct. 23. F. F. Weld, C.E.

Wide and Narrow Tires.

Sir: You say (page 441): "The effect of wide tires on traction is well shown in some experiments, etc. On a badly drained earth road, subjected to heavy travel, the wide tires required more traction (pull) than the narrow when there was mud. Also a well built, well drained, gravel road when dry." There is no effect of wide tires on traction about this. The only thing shown by these "tests" (so-called), is the effect of narrow tire roads and effects upon wide tires. They do not come anywhere near showing what wide tires in general use would do for traction; roads, vehicles and horses.

We know pretty well what narrow tires, the worse of bad-road-makers, do for us as to roads and streets, but we are so "left to ourselves," that we will not see that they are just as bad for vehicles and horses. What is it we want to know, anyhow? Is it the effect of narrow wheels in general use ("heavy travel," "heavy traffic"), on the pull of a few "test" wide wheels? If not, why will we continue to make "tests" which show this and nothing more?

The Missouri Experiment Station people tried "to be certain that their tests embraced all conditions of road surface usually found." But the effect of wide tires on narrow tire conditions usually found is just what we do not want. We want to get rid of all bad conditions usually found, not by the good-road-making hard-pull wide wheels, but by their easy pull, bad-road prevention. What do we care how much easier narrow wheels pull "in mud on a badly drained road subjected to heavy travel," if wide wheels would prevent the heavy travel, the bad drainage and the mud which so greatly increase the pull? The Missouri Experiment Station people made tests to approximate if possible the proportion of vehicles that would be required to use broad tires in order to eliminate this difficulty of rut influence on the draft of broad-tired wagons. But by making one-half of the wagon broad tired they succeeded only in eliminating the difference in pull, having reduced the initial test pull of the 1½-in. wheels from 343 to 321 lb., and the test pull of the wide 6-in. wheels from 521 to 321 lb. in one case. In the other case the 6-in. tires reduced the test pull of the 1½-in. tires from 422 to 362 lb. and the test pull of the 6-in. tires from 493 to 343 lb. These tests were made on "dry clay road; surface of road, hard," on March 22, 1897 and April 14, 1897. "On (probably same) clay road, dry, hard ruts almost entirely obliterated" the pull, on Nov. 20, 1896, was 76 lb. for the 6-in. tires, under "usual" or narrow-tire conditions, too. Not much elimination of rut-cutting influence of narrow tires in 343 or 321 lb. pull instead of 76 lb. or less.

You, of course, know, with Prof. Baker, that: "Narrow tires are much more destructive on any road, especially on earth road," yet you seem to allow that although the narrow wheel does more work of destruction on itself and on roads and streets, it gives the horse less occasion to exert pull, when that extra wear takes place on good, hard roads. This idea that you can produce more destruction, make more mud and dust with less horse power, by means of narrow wheels, is about as remarkable as any notion ever entertained by mankind. So-called tests seem to many people to confirm this idea, but that is so much worse for the "tests," and the people deceived by them, as well as all others. Studebaker didn't make a second pull (or trip) with the wide-wheels "tested." In one of the Missouri cases mentioned above the first trip of the wide tires showed up 180 lb more narrow-tire-rut pull than the second trip. Studebaker, by comparing the "good road-making pull of wide tires (a pull very largely due to narrow wheels) with the bad road-making pull of narrow tires, found all sorts of absurdities; such as: "You can haul 1,300 lb. more with given pull on 1½-in. tires than on 4-in. tires on (wood) block pavement," or "You can haul 600 lb. more on same," or "You can haul 200 lb. more on 4-in. than on 1½-in. tires." By the same token the Rock Island Arsenal "tests" showed that: "You can haul 13,235 lb. more (than 8,500 lb.) on a good macadam road with 4-in. than with 5-in. tires. You can haul 5,695 lb. more with 5-in. than with 4-in. You can haul 13,320 lb. more with 4-in. on Aug. 7 than with 4-in. on Aug. 11. It looks to me like a very poor "test" that never gets anywhere near the best work of wide wheels; the prevention of bad roads by abatement of narrow wheels.

Yours, etc., J. M. Heiskell.
Memphis, Oct. 27.

A Useful Logarithmic Diagram.

Sir: Logarithmic cross-section paper, although its properties are well known to engineers, appears to have found but limited application except by compilers of various kinds of engineering tables. It has been used also, to a certain extent, as a base for the graphical representation of hydraulic formulæ, for which purpose it is particularly applicable. A very useful, as well as simple, diagram constructed on this kind of paper is shown in the accompanying figure.

This plot gives, approximately, various powers from 0.1 to 3 of any number. For the solution of the several formulæ for the flow of water of the general form $V = C D^n S^p$ the diagram lends itself readily. For instance, take Lampe's formula $V = 77.7 D^{0.69} S^{0.56}$. With a pair of dividers, the logarithm of 77.7 is scaled off from the bottom of the diagram, to this is added, by an extension of the dividers, the length corresponding to $D^{0.69}$ and finally that corresponding to $S^{0.56}$. The final length thus obtained is then compared with the horizontal scale and the result read directly due attention being paid to the decimal point as in the case of the slide rule.

The diagram is also useful for the solution of equations containing higher powers of X, for the solution of which ordinary algebraic methods are impractical or impossible. For instance, an approximate solution of the equation $3 X^3 + 4 X^{0.4} + 2.6 X^{0.21} = 7$ may be quickly effected. Assuming a value for X the three terms are quickly scaled from the diagram and added, from the result of which a closer approximation and if necessary a third is made.

The above plot is easily constructed, the lines following simple laws, so that the problem is hardly more than an exercise in mechanical drawing.

Cambridge, Mass. W. L. Butcher.

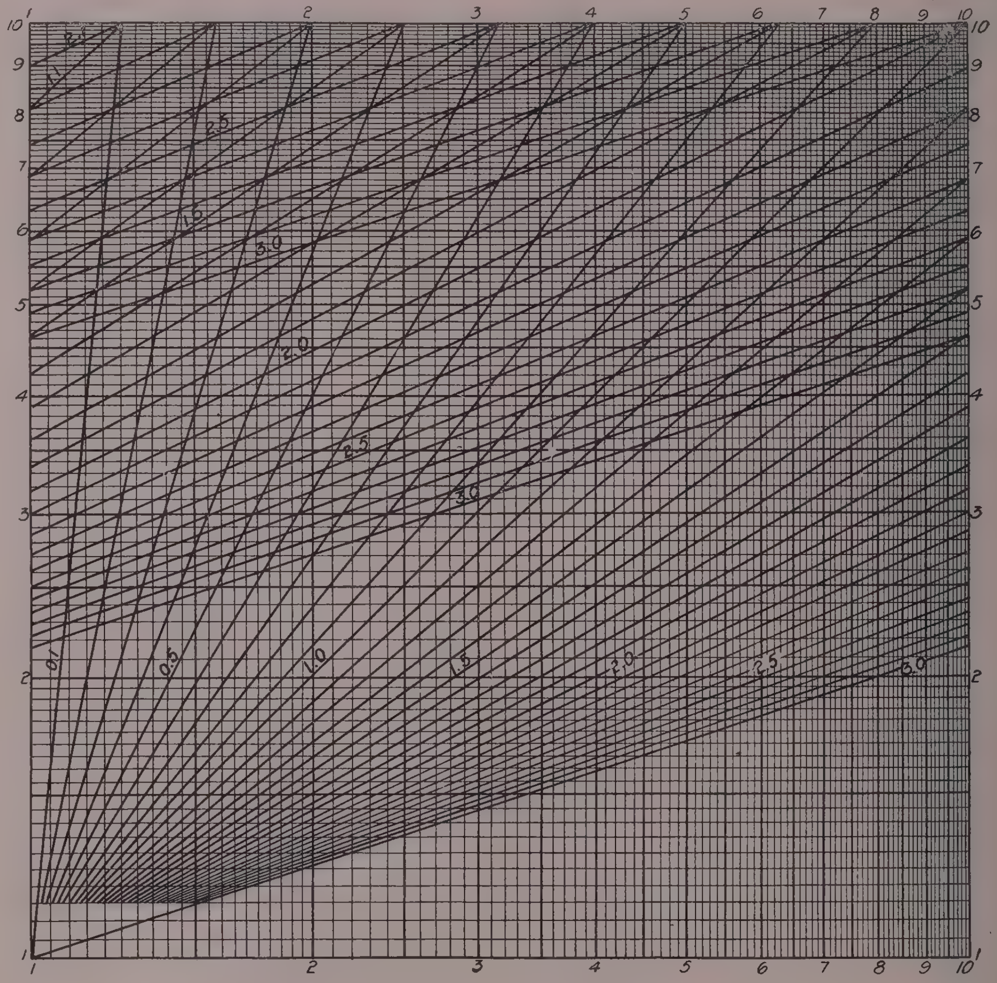


Diagram Showing Use of Logarithmic Paper.

Engineers and Architects.

Sir: Referring to your interesting article on the relations of the engineer to the architect (Oct. 14, page 432), is not the final solution of the question going to be the subdivision of the architectural profession, just as engineering has been subdivided? When a great engineering enterprise is undertaken the services of civil, mechanical and electrical engineers and possibly other kinds of engineers are required. So the design and construction of an important building should require the services both of the architectural engineer and of the artist architect. The first would have everything to do with matters relating to the soil, the drainage, foundations, structure, the power plant, the elevators, the heating and ventilating, the electric lighting, the plumbing and steam fitting, etc. The latter would advise the owner concerning the arrangement of rooms, the location of stairways, elevators, etc., the amount of light to be furnished to each room, the interior decoration, and the general outside effect from an artist's standpoint.

It is practically impossible for any one man to combine in himself the qualifications of both these men. The engineer may design a building that is strong, durable, economical and generally sensible, but it will be ugly. The artist architect may have his mind saturated with ideas of beauty, but he is not apt to be a good artist unless he can devote most of his time to the work of an artist, and not be compelled to use a great portion ot his time in doing the work of a constructing engineer for which both by taste and education he is unfitted.

Should not the engineering profession have an additional branch to those now existing, namely that of the architectural engineer, and should not the architectural profession be divided, say two-thirds of them being architectural engineers and one-third, artist architects?

Syracuse, Oct. 20. Wm. Kent.

Bedding Heavy Bridge Pedestals.

Sir: In your issue of Sept. 16 you mention the trouble bridge-building engineers have met with very often if they used lead for the distribution of pressure in bridge or column foundations. It may interest your readers that in Germany, in this case, it is now general to use what we call hard lead, an alloy of about 80 to 90 per cent. of lead and 20 to 10 per cent. of antimony.

In several cases, according to reliable reports, even this proved unsuccessful, especially under the very heavy traffic of the City Railway (Stadtbahn) at Berlin. Several years ago a great number, or all, the columns under the viaducts of that line had to be raised as the lead had flowed out and instead of this was inserted a copper plate, about ⅜-in. thick, if my memory is right. As far as I know this proved to be quite satisfactory.

Yours very truly,
K. A. Mittenhoff.
Wilkinsburg, Oct. 15.

CURRENT NEWS SUPPLEMENT

NOVEMBER 4, 1905.

DIRECTORY OF NATIONAL TECHNICAL AND TRADE SOCIETIES.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th St., New York. Next meeting, Nov. 15, paper on Duluth Ship Canal Bridge.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York.

National Fire Protection Association. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk Street, Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

American Public Health Association. Secretary, Dr. C. O. Probst, Columbus, O.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association.. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association.. Secretary, J. M. Diven, Charleston, S. C.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

American Public Works Association. Secretary, W. H. Flint, Chattanooga.

Association of American Portland Cement Manufacturers. President, J. B. Lober, 1232 Land Title Building, Philadelphia.

American Society of Refrigerating Engineers. Secretary, H. W. Ross, Room 806, 258 Broadway, New York. Annual meeting, Dec. 4-5; 12 West 31st St., New York.

National Association of Manufacturers of Sand-Lime Products. Secretary, H. A. Duerr, Wilmington, Del. Next meeting, Dec. 5-7, Detroit.

National Association of Cement Users. President, Richard L. Humphrey, Harrison Building, Philadelphia, Pa.

A REPORT ON RECENT PUBLIC CONSTRUCTION IN PHILADELPHIA.

It is probably well known that for some time Major Cassius E. Gillette, Corps of Engineers, U. S. A., and Mr. John D. Maclennan have been making an investigation of the condition of the water purification works and the Northern and Southern Boulevards in Philadelphia for Mayor Weaver. This report has been made public, and the following extracts give its leading features:

Cost.—Omitting from construction all small contracts, say, under $30,000, we find for the filtration work and the two boulevards, as constructed up to date, the city has paid or pledged $18,761,541. First class work under the specifications should not have cost over $12,430,000, which includes an allowance of 20 per cent., or $2,075,208 for legitimate contractors' profits. The difference is $6,330,000. In other words, $18,760,000 in round numbers has been paid for work costing the contractors $10,356,000.

Of the $6,330,000 excessive cost there has gone to the contractors who worked under the name of D. J. McNichol $5,065,122, similarly to Ryan & Kelly $543,890, and to Vare Brothers $89,128. Of the $18,761,141 there remains unpaid about $568,000 to McNichol and $75,000 to Ryan & Kelley.

Some of these contracts are incomplete. The estimated cost of completion of the existing filtration contracts at contract prices is about $1,685,000. A fair price, allowing 20 per cent. profit, would be $1,218,000. The difference the city will lose if these contracts are completed.

The price paid for the three-quarters of a mile of Northeast Boulevard already constructed is $552,348, on which there was a loss to the city of $273,217. There are nine and a half miles more of it laid out on the maps. If completed at contract prices the additional cost to the city would be about $6,500,000, and the additional loss at least $2,250,000. On the Southern Boulevard the amount paid to date is $286,389, on which the loss on the one and a quarter miles built has been $89,128. To complete at contract prices would cost $350,516, and the additional loss would be $85,555. In other words, the total cost of both boulevards as planned at contract prices would have been $7,636,000, and the total loss to the city $2,750,000.

Character of Work.—The above $6,330,000 is the difference between what has been paid and what should have been paid for first-class work, but much of the work done by Ryan & Kelley and D. J. McNichol is not first-class. The parts which show prominently to the public are fairly well done; the parts that can be examined with a little trouble are distinctly second-class, and not up to the specifications. We, of course, do not know the condition of such portions as cannot be seen without tearing up the work; but wherever we have dug into it, we find it second-class. or worse.

The Southern Boulevard work, so far as can be seen, is good work. As yet only the rough work of filling has been done.

On the Northeast Boulevard, the crushed rock used in surfacing is excellent material, but the foundation rockwork we find to be very poor. A friable micaceous rock was used, which will disintegrate under travel and make sinks in the crushed rock surface. These will require constant mending, making it a patchwork of roadway. It should be torn out and the foundation replaced with proper material.

The concrete work of the filtration contracts appears to be of fairly good materials, rather poorly mixed and not carefully placed. Plastering, washing and other expedients for covering cheap work were generally permitted. Embankment work was generally poor, manifesting itself in cracks and settlement.

While the specifications were unusually exacting, we have found few places where the work could have been more cheaply constructed without jeopardizing its stability, or its inferiority being apparent to the public. Indeed, three of the Belmont filters are badly cracked and will doubtless go to pieces many years before first-class work would have given away, and a large terra cotta drain at Roxborough is practically useless already. This pipe is twelve feet under ground.

Of the filtering materials furnished by McNichol and now subject to inspection, we find a large part of the sand to be a very inferior material, not up to the specifications in chemical quality or effective size and containing too much fine material. In addition, it is of a very dirty color and contains too much coarse material. These last two items were not specified, but should have been.

This poor sand is from the Delaware River. The rest of the sand is bank sand and generally of much better quality. In all the filters that have been completed the river sand is covered up out of sight by a layer of the much better looking bank sand. In addition to whatever effort to hide bad materials that may be involved in this, it is bad arrangement. The qualities of sand in a filter should be uniform from top to bottom. The gravel is decidedly dirty.

Restricting Competition.—One of the means by which these excessive profits were made possible was by not permitting fair competition.

The advertising for bids was wholly inadequate; scarcely more than a pretense. For a typical example, take contract No. 16 for Belmont filters and reservoir, costing about two million dollars ($2,000,000). This was advertised by three insertions each in the Telegraph, Inquirer and Gazette, all local papers, and notice first appearing twenty-four days before the letting. This was wholly inadequate. The work to be done was very complicated and very difficult to estimate. The specifications were voluminous and vague, covering 112 printed pages. The drawings covered no less than forty-three large sheets of close complicated work, each sheet over ten square feet in area.

It was quite impracticable in the time allowed for even a local contractor, noticing the advertisement the first day it was published, to make up his estimate of quantities alone, to say nothing of the many other things a bidder must do, before he can submit an intelligent bid. There was no advertising for this large contract in any of the engineering journals, where contractors look for such notices.

It is also customary in engineer offices to keep lists of contractors to whom specification or invitations to bid are sent, without asking. Nothing of this kind was done. This is a fair sample of the notice given for the large contracts for the filtration works.

A Sample Letting.—The history of the boulevard advertising is as follows: A survey was made and the Northeast Boulevard laid out by private parties before the city had anything to do with it. Councils passed the ordinance to fit this survey. The work was afterward laid out by the Bureau of Surveys in accordance with the ordinance. This brought it sufficiently close to the map previously made by private parties to make no change in the list of properties benefited or the list of lots from which the city must buy, if it completes the work.

The specifications were very voluminous, and include eighty-two different items, the most of which required special and painstaking calculation to cover the many details. These specifications were available to bidders ten days. The bids were opened March 25, 1903, three days before the ordinance authorizing the advertisement for bids were approved. Eighteen persons had asked for specifications. McNichol was not among them, nor is he on record as having taken out specifications for the Southern Boulevard, yet he bid on both. Only two bids were received, and there is a remarkable unanimity in the prices.

The advertising was as follows, the first appearance being fourteen days ahead of the ordinance authorizing the advertisement: The Item, March 14, 17 and 24, 1903: The Inquirer, March 16, 21 and 25, 1903; German Gazette, March 18, 19 and 23, 1903; Sunday World, March 15, 1903; Sunday Despatch, March 15, 1903; Sunday Transcript, March 22, 1903. Under these circumstances real competition was out of the question.

On the Southern Boulevard, the ordinance authorizing the work was approved June 27, 1904, and the bids were opened July 28, 1904. The advertisements appeared as follows: The Inquirer, July 19, 23 and 28, 1904; The Item, July 19, 22 and 26, 1904; The Telegraph, July 21, 25 and 28, 1904; The German Demokrat, July 20, 23 and 27, 1904; Sunday Despatch, July 24, 1904.

This advertising does not even comply with the law, which requires at least ten days for the smallest contract. The dates of advertisements and opening bids are fixed by the Director of Public Works.

Filtration Contracts.—A careful analysis of all the filtration advertising indicates that everything possible was done to avoid any real publicity without letting that fact appear too prominently in the records. Had the bids been itemized, as they should have been, bidders could have made intelligent bids upon the different classes of work at unit prices, and the period allowed would not have been so unreasonably small. But this was not permitted, except for pipe lines. Lump sum bids were required, which demanded that the bidder make careful detailed estimates of quantities.

The bureau's preliminary estimates, instead of being freely furnished to bidders, were rigorously guarded secrets, so far as the general bidder was concerned, except that they were furnished in the specifications for filtering materials, where they were very little needed.

The specifications in many particulars were unfair to bidders and gave excessive and unnecessary power to the city officials. For example, in the above contract for Belmont, one paragraph gives the engineer power in his discretion to require the contractor to do more than $100,000 worth of extra work, for which he would receive no pay whatever. It was provided that if the earth foundations when uncovered were not "satisfactory" to the engineer, he could require the contractor to excavate to any depth he pleased and fill it up with concrete without expense to the city.

In many cases the specifications gave the Director of Public Works authority to change the plans and specifications to an unlimited extent and to fix the price of the work as changed. In one case this power was exercised to make not less than sixty-two material changes in the plans. No less than eighty-nine supplementary sheets of drawings were made after the contract was let. The contractor, George C. Dietrich, went into bankruptcy. This case will be discussed at length further on.

In the specifications for the conduit, a rock-tunnel from end to end, the contractor was required to "provide a shield and excavate by the pneumatic or other improved method when or where, in the judgment of the engineer, it is necessary for the safety or better progress of the work," and he must "work in the tunnel and shafts in compressed air whenever, in the opinion of the engineer, the conditions are such as to require it." These provisions put it in the power of the engineer to add greatly to the contractor's expense. That they were intended to be taken seriously is shown by the elaborate compressed air regulations accompanying them. In the actual work nothing of the kind was used.

In the specifications for filter sand and gravel there was inserted a paragraph which gave the Director so much authority to make changes in the sizes that it could easily have been used to double the cost of the contractor, without any increase in his prices.

The specifications were generally very severe, very vague in some respects, very elaborate and involved, and altogether too much was left unnecessarily to the discretion of the engineer to make it safe for the general bidder to submit a bid at a reasonable price.

Delays.—Another provision of the specifications which must have intimidated many bidders was the threat of assessment of liquidated damages at rates of from $50 to $1,000 per day for each day overtime. If a bidder received private information that this would not be enforced, he could ignore it; but no other bidder would dare propose to complete the work in a shorter time than he could actually expect to finish it.

The McNichol bids always proposed strikingly short periods for completion—much shorter than would ordinarily be required to do the work; and the proposed time was always exceeded by from 10 to 200 per cent.

In the aggregate McNichol could have been assessed for liquidated damages for overtime about five hundred and thirty-two thousand dollars ($532,000). He was actually assessed $3,255.

Three-fourths of this assessment was on the first filter contract, and must have made bidders on the later contracts think the assessment clause would be enforced.

A rather ingenious device in this connection was to delay the date of notice to McNichol to begin work. For instance, in the case of the conduit above mentioned, the work was to have been done in nine months after notice to begin was given. This notice was dated seven months after the letting and four months after the award. It had been previously sent and withdrawn at the contractor's behest for very trivial reasons. It was not sent finally till the contractor had let his subcontracts and he and all his sub-contractors had gathered and installed their machinery and been actually at work on the ground over three months. Five of the nine working shafts had been sunk to bed rock and lined with steel. Three more reached bed rock a few days later.

On another large contract (No. 50) the notice to begin was delayed six months. It was originally given one month after the letting and then cancelled. The contract was for filtering materials, and the reason given for the cancellation was that no filters were ready. If not, then the advertising of this contract was inexcusably short. The contract was for over a million dollars, and it was advertised for just fourteen days.

These facts prove conclusively to our minds that the time of completion and liquidated damage matters were used for the distinct purpose of juggling the contracts into the desired parties' hands.

Whether or not they were put into the specifications for this purpose we, of course, do not know. They never appear to have been used for anything else.

The fact that nothing was ever assessed against any other bidder except McNichol is unimportant. The other bidders never could assume this in stating their proposed time of completion. In this connection the wording of this in the specifications and in the contract forms is worthy of note. In the specifications it states that the Director "is hereby authorized to deduct and retain out of the payment the sum of ——— dollars as liquidated damages, and not as a penalty, for each and every day occupied beyond the time so stipulated." In the contract form, "It is understood and agreed that the sum of ——— dollars per day shall be deducted," etc.

This may not be legally mandatory on the Director, but an ordinary bidder reading it would hardly dare propose a shorter time than that in which he could expect to do the work.

Bonds.—Some rather burdensome laws and ordinances concerning contracts were used and added to in a manner that must have helped eliminate competition. These require that a bidder must file a bond of $500 with the City Solicitor, paying a small fee. He must also secure a bondsman to be bound with him for a large penal bond if he gets the contract. Then he must be ready to give another bond equal to half the amount of the contract to insure its faithful performance. These would seem discouraging enough to prevent people from lightly bidding, but there was added the necessity of depositing $10 to $100 to get specifications and a certified check for sometimes as high as $40,000 had to be deposited with each bid. The bondsman once named could not be changed, and for some reason bidders outside of a certain few could not get surety companies to go on their bonds for Philadelphia city work.

The reason for this we have not yet fully ascertained, but as it was known to bidders it should have been known to the officials. We have found no efforts on the part of the latter to change this condition or otherwise relieve bidders from it. After a bidder had gone through all the trouble and expense involved in bidding under the conditions described above, and being the lowest bidder had seen the contract given arbitrarily to McNichol or Ryan & Kelley or readvertised, it is easily seen how he would soon quit bidding on city work.

We have received testimony from many contractors that the conditions described above kept them from bidding. We have also received statements that city officials directly discouraged bidders from submitting bids. This field has not yet been fully explored.

Estimates.—The Bullitt law governing city contracts requires that "every contract for public improvement shall be based upon an estimate of the whole cost, furnished by the proper officer through the department having charge of the improvement, and no bid in excess of such estimate shall be accepted." We find that this law appears to have been generally complied with, so far as making the preliminary estimates was concerned, but thereafter it was generally violated, as the large contracts, wherever we have been able to make comparisons, were frequently for sums much in excess of the estimates.

For Contract No. 25, Torresdale filters, McNichol's accepted bid exceeded the official estimate by nearly two million dollars. For No. 14, for Torresdale conduit, his accepted bid exceeded the estimate $425,000, and No. 23, for pipe lines, $235,000. Contract No. 25, on which the excess was nearly $2,000,000, was for fifty-five filters.

Another contract, No. 54, was subsequently let for ten more filters alongside the others. On this McNichol's accepted bid only exceeded the estimate by $20,000, but there were some remarkable deviations in the figures of the estimates. For instance, excavation in the first case was estimated at 30 cents a cubic yard; in the second at $1 a yard. The character of the excavation in the two cases is precisely the same.

The second estimate was markedly higher than the first in the following items among others: Earth fill, dry brick walls, piling and expanded metal were assumed in the second estimate at twice the prices used in the first. Concrete was increased 24 per cent.; brick masonry 75 per cent. Cast iron was increased to two and a half times its former estimated cost. Steel was increased 75 per cent., and lumber 50 per cent.

These changes in the estimated figures made less discrepancy, of course, between the estimate and the bid. The bids were about the same and essentially the same prices were used in computing the monthly estimates for payment in each contract. As the contractor had all his plant on the ground that he had used in building the other fifty-five filters adjoining, it is a little remarkable that he did not offer to do the work at a much lower price. These ten filters were originally designed to be built at the Queen Lane Reservoir. This plan was changed in time to let the contract so that the work just followed McNichol's completion of No. 25.

Ryan & Kelley's accepted bid for Belmont exceeded the estimate by $428,000. We do not find these large discrepancies on contracts let to other people. George C. Dietrich had an excess of $22,000 on No. 29, and R. A. Malone & Co., $1,500 on No. 27, each contract being for over half a million dollars.

Enforcement of Specifications.—In the execution of the contracts there is a wide field to investigate. We have not been able to cover it all, but we have found many cases where the vague paragraphs in the specifications giving undue authority to the city officials have been used to harass certain contractors and to favor McNichol and Ryan & Kelley. For instance, the paragraph in Ryan & Kelley's contract for Belmont, calling for replacing unsuitable foundation with concrete, without charge, was not enforced. When a poor piece of ground was encountered it was not removed and filled with concrete free of cost, but a grillage of timber was placed under the puddle and paid for as an extra.

Similarly, McNichol in contract No. 25, which had the same provision, instead of being required to put in concrete free of cost was allowed to put in cobbles and gravel and was paid for it at $1.38½ a cubic yard, the amount paid being $28,349.57. In recommending this payment Mr. Hill states under date of January 22, 1903: "I do not think that the ordinary saving clauses in this contract would require the contractor at his own expense to construct the work as herein mentioned."

The contract provides specifically for precisely the opposite. It says: "Par. 34, additional depth: If in the opinion of the engineer, the foundation when uncovered is not satisfactory, the contractor shall carry the excavation to such additional depths as may be directed and shall fill up to the under side of the puddle with concrete prepared and mixed, as specified under concrete, without additional cost to the city."

As the contract provided for additional concrete at a bid price we can see absolutely no reason for putting this great contingency on the contractor in the specifications, except to frighten bidders. But it is there definitely and unequivocally, and releasing Contractor McNichol from it was wholly improper. The payment to him of $28,000 for filling the place was precisely the equivalent of a presentation to him of that much of the city's money. Had he been compelled to comply with the specifications, it would have cost him four or five times that amount. Why the above paragraph in the specifications should be considered merely a "saving clause" we cannot understand.

In the filter contracts we find an unusual paragraph, requiring the faces of concrete walls to be made of a stiff granolithic mortar "which shall be deposited by skilled workmen against the face forms with a least thickness of one inch, in advance of and supported by the backing concrete, the stones of which shall be well worked back from the face." This difficult operation must have deterred many bidders or caused them to bid high prices. We find little indication that it was ever enforced. All these filter contracts went to McNichol and Ryan & Kelley.

Unpopular Contractors.—On the other hand, we find that when others than Ryan & Kelley and McNichol got large contracts they received decidedly different treatment. There were only two of these, outside of contracts for machinery. They were R. A. Malone & Co., for the Oak Lane reservoir, contract No. 27, and George C. Dietrich, for Lardner's Point Pumping Station, No. 2, contract No. 29.

In the first of these the treatment consisted in the rigid and literal enforcement of severe specifications. The work was practically finished nearly a year ago, but over $50,000 is still held up pending some tests, not in the specifications, but, perhaps, inferable from them.

In the other case the specifications appear to have been not only rigidly enforced, but the chief engineer assumed many prerogatives not provided by them to the serious injury of the contractor. This contractor, financially ruined, makes a profusion of claims and charges; but we have not in this matter or in any others constituted ourselves a court to balance opposing claims, and we therefore only use in this report such statements as are borne out by the records or verified by the assistants who represented the city in direct charge of the work.

Results of Delays.—A proper distribution of the construction work, by means of itemized bids, among experienced contractors, would have accomplished this easily within the above time, and the work being done by contractors who had made a specialty of particular branches, would have insured to the city a completed system of first-class work. No one contractor or firm of contractors is likely to possess the experience and ability to cope with all the many varieties of construction work involved.

The filtered water district of West Philadelphia has been supplied with filtered water since June 6, 1904. During the sixteen months that have elapsed since that date, up to the first of this month, only ten persons out of a population of 41,000 in that district have died of typhoid fever, and of these only one is properly attributable to this district, and even that one is uncertain.

At the same proportional rate, the deaths in the whole city, since January 1, 1904, when the filtered water system ought to have been completed, should have been 57 or less, whereas 1,257 have died. The difference, 1,200 deaths, represents the loss of life due to the methods that have been employed in conducting the work. The entire amount necessary to complete the system could have been borrowed at the beginning of the work.

We have made complete lists of all the above deaths, and have traced each case that occurred in the filtered water district mentioned.

Since January 1, 1904, the total number of cases of typhoid, including deaths in the city, was 11,978. Had there been a filtered water supply for the whole city during this period only a small percentage of these cases would have occurred, and in all probability typhoid would practically not exist in the city to-day.

CONDITIONS ON THE ISTHMUS OF PANAMA.

The "Times-Democrat" of New Orleans has published an interview with Major B. M. Harrod, of the Isthmian Canal Commission, which is particularly interesting from the fact that the gentleman granting it is the only Commissioner who has held office continuously since the beginning of the work. Consequently, he is unusually well qualified to judge of the progress and prospects of affairs on the Isthmus. The interview reads as follows:

Major Harrod reported that, since his former visit to the Isthmus, on July 8, there has been a marked change for the better in the situation there. The accommodations for skilled labor have been vastly improved, and the American colony of wage earners appears satisfied with existing conditions. The government has built commodious houses for men of family, and hotels to the number of seven for single men, where good fare and comfortable lodging are furnished them. This improvement has had a fine effect upon the morale of the men, and a feeling of content has succeeded the former demoralization.

American labor, mostly confined to the skilled variety, is paid in gold or its equivalent in United States currency. Native labor, canal diggers and others of the lowest paid class receive their wages in the current silver coin of the Republic of Panama, which is worth 50 cents on the dollar of our money. The labor question has been satisfactorily solved by the employment of natives of Panama and the islands of the Caribbean Sea, notably Barbados, Martinique, Colombia and Jamaica. This class of labor is available in countless numbers, and there will be no necessity, as was once thought, for the importation of coolie or other Asiatic labor. They are paid 17 cents an hour in silver, are inured to the climate, and though not very efficient, will serve the purpose of the commission. There are about 13,000 men now employed by the commission, of which number about 10,000 are natives. Major Harrod does not think there will be occasion for more than 20,000 or 25,000 men, and they are coming of their own accord from neighboring islands in such numbers as to threaten an oversupply.

The progress of the work, said Major Harrod, since his previous visit there in July, has been mainly of a preliminary character. There has been some excavating done, but the bulk of the work thus far has been to provide suitable quarters for the men and establish a good system of food supply and cold storage facilities. Much time has also been spent double tracking the railroad, building switches for dumps and otherwise getting ready for the great work.

When Major Harrod left there, October 11, there was but one case of yellow fever on the Isthmus, and, with that exception, there had been no cases for a period of thirty days. In fact, the American Sanitary Commission is offering a reward of $50 for any authenticated case of yellow fever that may be discovered.

The sanitary conditions of the Isthmus have been brought to a very satisfactory state under the direction of the United States authorities. A new system of waterworks has been installed in Panama, furnishing an abundant supply of pure water from the headwaters of the Rio Grande, about fourteen miles distant. A sewerage system is approaching completion and street paving is well under way. At Colon also a waterworks system has been installed furnishing excellent water from the Brazos River. Good water has long been a desideratum on the Isthmus and its absence greatly enhanced its former unhealthy condition. Now that this defect has been remedied, there is no reason why Panama should not be redeemed from its unfavorable reputation with respect to health conditions.

Major Harrod was naturally not inclined to discuss the relative merits of the lock or sea level systems of canal construction, as that question is now being considered by higher authorities. The advisory board met in Washington on September 1 and was placed in possession of all information gathered by the Panama Canal Commission. All facts and plans were laid before them in detail, coupled with an invitation to visit the Isthmus. The advisory board accepted the invitation, and spent eight days on the Isthmus, making a thorough examination of its topography, hydrography and physics. They then came back to enter upon the preparation of their report, which Major Harrod expects will be ready in November for presentation to the commission. The commission will then transmit the report to the President of the United States and all the documents will probably come before Congress when it meets in December.

Asked as to when the canal would probably be completed, Major Harrod referred the reporter to the report of the "Commission Technique," appointed by the new Panama Canal Company, a French corporation, or to the report of the United States Commission of 1901, which reports estimated the time necessary to complete the canal at seven or eight years. Those plans were submitted to the present Panama Commission, together with plans prepared by outside parties, and all of them are before the advisory board for rejection, modification or acceptance.

"There is complete harmony now," said Major Harrod, "between the chairman of the commission and its members. The executive committee confines itself to the business end of the work, and the engineers to the practical part of it."

"There has been some doubt expressed," said the reporter, "as to the practicability of building a canal across Panama. Is that doubt well founded?"

"Emphatically not," replied Major Harrod. "There is no doubt whatever as to the thorough practicability of building the canal across the Isthmus chosen for it."

THE NATIONAL ASSOCIATION OF CEMENT USERS.

The Board of Directors of the National Association of Cement Users held two important meetings in April and September, in the first of which, in addition to the routine business of the Association, the Board arranged for its representation on the advisory board of the experiments on structural materials in progress in St. Louis, Mr. Richard L. Humphrey, the president, being the representative appointed. Mr. Humphrey is the secretary of the advisory board. At a meeting of societies and representatives of departments specially interested in tests of the fireproof qualities of concrete, Mr. Humphrey was made chairman of the committee formed to consider and advise regarding these experiments.

At the September meeting plans were made for the convention to be held in Milwaukee, Wis., Jan. 9 to 12, 1906. A. Moensted, fourth vice-president of the association, is the local representative of the board at Milwaukee, and will give any desired information.

The sessions of the convention will be held in a commodious hall in the Armory building, which is located in the center of the hotel district. The exhibit of materials and appliances will be held in the drill room of the Armory, which is a large, well-ventilated and well-lighted room. Should the exhibit space required be greater than was used at the last convention there are several adjoining rooms and halls in the same building into which it can overflow. The room is on the ground floor and heavy machinery can be unloaded directly upon the exhibitor's space. A number of applications for space have already been received and others should be made to the secretary, Charles Carroll Brown, at the association's headquarters, 310 Commercial Club Building, Indianapolis, Ind.

But little can yet be said about the program for the convention, but that little is very encouraging. The committees having charge of the program are at work and promise good papers and opportunity for full discussion. The following papers have been definitely promised: "Air Tamping of Concrete Blocks and Conveying of Blocks," by J. P. Sherer, Milwaukee, Wis.; "Observations on the Testing and Use of Portland and Natural Cements," by E. S. Larned, C. E., Boston, Mass.; "Building Regulations Regarding Concrete Blocks," by Will J. Scoutt, Chicago, Ill.; "Concrete as a Fireproof Material," in some of its special phases, by E. T. Cairns, chairman Committee on Cement for Building Construction of National Fire Protection Association, Chicago, Ill.; "The Use of Cement and Concrete for Farm Purposes," by S. M. Woodward, of the section of irrigation and drainage investigations, office of experiment station, U. S. Department of Agriculture, Washington, D. C.; "Waterproofing," by J. L. Mothershead, Jr., Indianapolis, Ind.; "Causes of Failures in the Concrete Block Business," O. U. Miraele, Minneapolis, Minn.; "Reinforced Concrete," in one or more of its branches, by C. A. P. Turner, M. Am. Soc. C. E., Minneapolis, Minn.

The experiments at St. Louis will be described by President R. L. Humphrey, and a number of other papers have been provisionally promised and will be announced later.

The usual convention rates will be granted by the railroads. Milwaukee is noted as a hospitable convention city, with many good hotels at reasonable rates. The convention promises to exceed in interest and in attendance the very successful convention held at Indianapolis last January. Further information, membership blanks, copies of the proceedings of the last convention, can be obtained of the secretary, Charles Carroll Brown, 310 Commercial Club Building, Indianapolis, Ind.

A BOLIVIA-CHILE RAILWAY CONCESSION.

Mr. Edward W. Ames, secretary of the U. S. Legation at Santiago, furnishes a copy of the decree recently issued by the Government of Chile regarding an agreement entered into between Chile and Bolivia for a railroad from Arica to La Paz, and inviting bids for its construction. Following is an abstract of that portion of the decree which invites bids for the construction of the road:

Article 1. That bids be called for for the construction, at a fixed price, of a railroad with one meter gauge to unite the port of Arica with the plateau of La Paz and with branches to the sulphur deposits of Tacora, the mines of Coro-coro and the port on the River Desaguadero. As for the branches, their cost shall be stated separately and the Government reserves the right to exclude from the proposals one or more of them. The bidders may adopt the line proposed by the engineer, Mr. Josiah Harding, or any other which, having been by them presented, shall be accepted by the Federal Government, and the bidders shall be bound by the terms of contract approved by it.

Article 2. Payment for work completed shall be made in quarterly instalments, 10 per cent. of the amount of each instalment being retained as a guarantee of the State's securing good construction and a line easy of operation.

For the purposes of making over the 10 per cent. retentions, the total length of the line shall be divided into three sections, three of which shall consist of that part of the line constructed in Chilean territory and two of that part situated in Bolivian territory.

As regards the first three sections, the payment of the 10 per cent. retentions shall be made for the three together in two equal payments, the first half on the provisional acceptance of said sections, the second, one year after they have been in operation. The payment of the 10 per cent. retentions on the other sections shall be made in the same way for each of them separately.

Article 3. The bids shall be accompanied by a certificate of deposit for £50,000 sterling to the order of the Government of Chile, as a guarantee of good faith, and this sum shall be forfeited to the Treasury if the bidder does not sign the proper public form of contract within the thirty days subsequent to the acceptance of his bid. The bidder whose bid shall have been accepted shall increase this deposit by £50,000 on signing the contract, and this total of £100,000 shall be added to the 10 per cent. retentions for which the previous article provides. These deposits may consist, originally or by subsequent substitution, of mortgages of the Mortgage Bank or other similar institutions which the President of the Republic shall elect, or in bonds of the public debt of Chile, valued at the current market price, the interest on which the contractor shall receive.

Article 4. To the bidders whose bids are not accepted their certificates of deposit shall be returned. In the case of the accepted bid, the deposit of £100,000 guarantee of contract shall be returned as follows: One-third on the definite acceptance of the first three sections, the second third on the definite acceptance of the complete work, and the balance one year after the whole line has been delivered to traffic.

Article 5. The use of such government lands as he may need for the railroad and its stations and offices, as well as the use of the public roads, is granted the contractor, provided that the traffic be not hindered by such use. He is also granted, on the same condition, the right to use, grátis, all spring water necessary for his engines and stations and the motive power of the rivers all along the line, with the sole object of operating his installations and engines and without detriment to rights acquired previous to August 15, 1905.

Article 6. Such privately owned lands as are necessary for the establishment of the line, stations, offices, and other dependencies of a railroad line are condemned by right of public domain during the period of constructing the railroad. The cost of such condemnations shall be borne by the contractor, who shall, moreover, set about effecting them in conformity with the legal or executive dispositions of the country concerned.

Article 7. The engines, cars, and other materials necessary for the construction of the road and its stations, offices, and docks, and the equipment necessary for the delivery of the line to the public service shall be declared free of import duties, and of all federal and municipal taxes.

Article 8. The contractor shall be obliged to respect the agreement of the Government of Chile with that of Bolivia concerning the construction of the railroad line.

Article 9. The bidders must give the name of the capitalist or capitalists on whom they count for support in carrying out the work.

Article 10. The administration of public works shall supervise the construction of the railroad and shall see to the faithful fulfillment of the contract.

Article 11. The contractor and the persons or companies who represent his rights, even if they be foreigners or do not reside in Chile, shall be considered as having a civil domicile in Santiago, Chile, and shall be subject to the country's laws as if they were Chileans in whatever concerns the fulfillment of the contract, it being understood that they shall, under no pretext, have recourse to diplomatic support in any difficulty which may arise because of said contract.

Article 12. The following circumstances shall be given much weight in considering the acceptance of a bid:

(a) The lowest price at which it is offered to construct and equip the railroad.

(b) Conditions which, in the opinion of the administration of public works, render its construction most economical and promise the greatest stability to the work.

(c) The condition of receiving payment for the work in bonds of the public debt, the lowest rate of interest on those bonds, and the best price at which it is offered to receive them.

Bids will be opened January 2, 1906, at 2 p. m., at Santiago, before the sub-secretary of the ministry of foreign affairs. The work of construction must begin before the 1st of March, 1906.

THE PRESERVATION OF NIAGARA FALLS.

On Wednesday the Acting Secretary of War sent a letter to the Governor of New York, calling to his attention the resolutions adopted by the International Waterways Commission at Buffalo regarding the movement started by President Roosevelt to save Niagara Falls from obliteration. The letter reads as follows:

At a meeting of the International Waterways Commision, held at the office of the American section at Buffalo, on October 28, 1905, the following resolution was adopted:

"Resolved, That this commission recommends to the governments of the United States and Canada that such steps as they may regard as necessary be taken to prevent any corporate rights or franchises being granted or renewed by either federal, State or provincial authority for the use of the waters of the Niagara River for power or other purposes until this commission is able to collect the information necessary to enable it to report fully upon the conditions and uses of these waters to the respective governments of the United States and Canada."

In bringing this resolution to your attention I have the honor to suggest that it receive your most careful consideration with a view to carrying out as far as may be practicable the recommendation of said commission.

THE IRON AND STEEL SITUATION.

The conditions in the iron and steel industries up to Wednesday of this week have been summarized by the "Iron Age" as follows:

Contracting for material continues on a very liberal scale, for which a good proof is furnished by the fact that the United States Steel Corporation had on its books on October 31 over 6,300,000 tons of orders. In pig iron, contrary to expectations, a fresh buying movement develops on the heels of the earlier activity. It is understood that the Steel Corporation has taken advantage of the options which it had on November and December iron, and has bought about 20,000 tons of pig iron besides. It characterizes the situation that it proved impossible for a large interest to secure from 20,000 to 25,000 tons of metal at Lake Erie's furnaces for shipment to Chicago before the close of navigation. There was no spot iron to be had. In the Pittsburg district about 30,000 tons of Bessemer basic pig have been purchased by outside interests for delivery during the first quarter, a period which the Steel Corporation has not yet considered. The buying and option on the part of the steel interests have created quite a flurry among the malleable iron foundries, which have been rushing into the market east and west. One concern in the Chicago district has bought 9,000 tons of malleable Bessemer and 12,000 tons of charcoal iron. Two smelters in Milwaukee have bought 20,000 tons of foundry iron between them, and a string of good sales, aggregating from 20,000 to 25,000 tons, are reported by New York sellers. So far as tne Southern situation is concerned it is clear that buyers are getting better accustomed to the idea of paying $14 for No. 2 foundry at Birmingham, at which the principal sellers are holding. The rail trade has been rather quiet during the last week. Outside of a lot of 12,500 tons for a coal road there have been only additions to former contracts. In the structural trade it is of interest to note that next week probably both the new mill at Chicago and the new Clairton mill will be producing. A good part of the tonnage has been sold, however. The most interesting contract of the week is that of 12,000 tons for the new Ohio Bridge at Ironton. In the lighter lines the most noteworthy fact is that the demand for tin plate has continued to develop. It is intimated that prices may be soon put up, and that this may be done, too, in the case of sheets.

A NEW TYPE OF OIL FILTER.

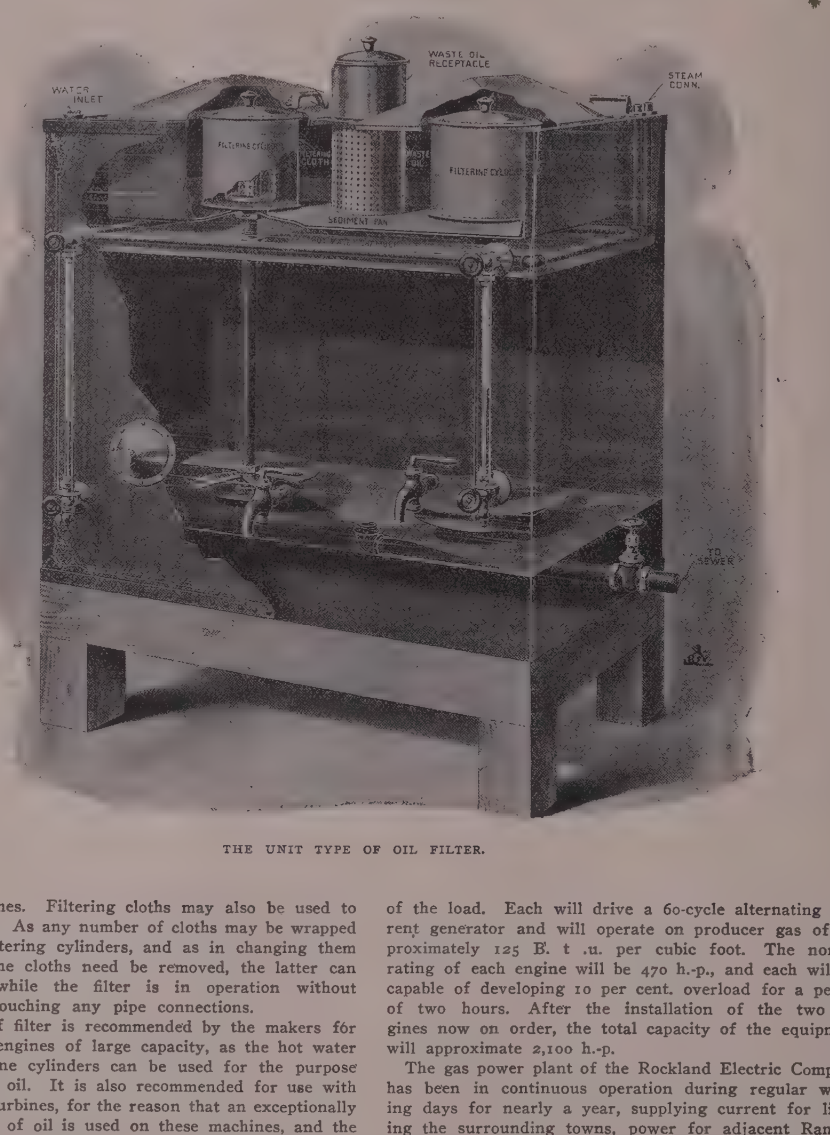
In many cases where a steam or gas power plant is installed, it is known from the outset that a larger equipment will be needed before long, and large auxiliary apparatus is purchased with that end in view. In some cases this use of large apparatus is not entirely satisfactory, and it is better to employ equipment adequate for present needs and duplicate it when necessary. A new system of oil filters, called the "Unit" type, has recently been brought out to answer just this purpose, each unit being independent in itself, but designed so that two or more of them can be coupled "in parallel" in a battery.

A section of one of these units is shown in the accompanying illustration. The dirty oil enters a waste oil receptacle and passes through small perforations, flowing thence horizontally to two filtering cylinders; in passing into these two cylinders the heavy impurities fall by gravity into a sediment pan, being thus finally disposed of and not clogging the filtering cloths or filtering material. The filtering cylinders are wrapped with cloths through which the oil passes before entering the cylinders, and are filled with a quantity of animal bone black, through which the oil must flow before entering two tubes which lead from the cylinders to the bottom of the filter. Two plates are attached to the bottom of the tubes by means of which the oil is spread out in a very thin film. It is thus thoroughly washed by the water in the filter and any remaining impurities in the oil drop to the bottom and can be flushed out at any time by simply opening the gate valve which connects with the sewer or other waste pipe.

A hot-water chamber surrounds the upper part of the filter containing the filtering mechanism. The water in this chamber is heated by a small steam coil fed with live or exhaust steam from any convenient source. The oil is thus heated before filtering and flows more freely, thereby increasing the speed of filtration and the filter capacity. When heated, the dirty oil spreads out, and most of the dirt and grit then falls into the sediment pan. The bulk of the sediment in this type of filter is at the top, where it can be readily removed without interfering in any way with the supply of pure oil for the oiling system. The filter will handle successfully the heaviest grades of oil, such as lard, gas engine and cylinder oil.

In the construction of the unit type, heavier iron is used than in the regular type of filter, and the body is riveted to a heavy wrought-iron frame. All seams are lapped and soldered. The upper and lower part of the filter cylinders are made of cast iron, nickel plated on the top. The tubes leading from the filtering cylinders to the bottom of the filter are of wrought iron. The filter is so constructed that it may be used with or without an oiling system. It can, if desired, be installed and operated at first without being connected with an oiling system, and later on, if an oiling system is added to the plant, pipe connections can readily be made thereto at slight expense.

It is not necessary to shut down a system and disconnect the pipe connections in order to clean the filter. If more than one unit is used it is only necessary to shut off the flow of oil to the filter to be cleaned, the other units being able to handle easily the extra amount. When only one filter is installed, the cloth around one cylinder can be removed instantly; if the filtering material also needs to be removed, one cylinder is unscrewed and a plug furnished for the purpose is screwed into the tube, so as to keep the dirty waste oil from flowing into the filter. The other cylinder continues in operation while the first is being cleaned. Any type of filtering material can be used in the cylinder, such as white waste, sponges, excelsior, raw wool, etc. The manufacturer recommends the use of animal bone-black, which is in use in all oil refineries for purifying oil. This material can be washed with hot water or gasoline and used many times. Filtering cloths may also be used to purify the oil. As any number of cloths may be wrapped around the filtering cylinders, and as in changing them nothing but the cloths need be removed, the latter can be removed while the filter is in operation without changing or touching any pipe connections.



THE UNIT TYPE OF OIL FILTER.

This type of filter is recommended by the makers for use with gas engines of large capacity, as the hot water from the engine cylinders can be used for the purpose of heating the oil. It is also recommended for use with gas or steam turbines, for the reason that an exceptionally large quantity of oil is used on these machines, and the oil being very thin will flow rapidly through this type of filter, owing to the effect of the hot water chamber at the top. These filters are being introduced by the Burt Mfg. Co., 244 Main St., Akron, O., which has been making other types for many years, and has embodied in the "Unit" the features which long experience with them has shown to be best suited for the service for which the new type is particularly designed.

Readers of this journal must have been impressed lately with the rapid increase in the number of applications which are being made of the Morse silent rocker-joint chains. These are used in a great variety of places where the distance between the driven and driving shafts is too short for belts or where gears would be too noisy, while in other types of equipment they are employed where a large amount of power must be transmitted in a noiseless yet economical manner under conditions that render a belt drive undesirable. The company describes the construction of the chain in much detail in its catalogue No. 7.

ENLARGEMENT OF THE ROCKLAND GAS ENGINE PLANT.

To the Rockland Electric Co., of Hillburn, N. Y., belongs the credit of inaugurating an interurban electric supply system from by-product producer-gas fuel in connection with power and fuel gas supply to adjacent industrial works. The use of gas power arose from the extremely low fuel cost of gas power and from the advantages of fuel gas in furnace work. The present power equipment, totaling about 1,075 h.-p. generating capacity, not including an exciter unit, consists of three 19 x 24-in. Westinghouse double-acting gas engines, direct connected to 225-kw. Westinghouse two-phase generators and a 75-kw. Westinghouse vertical three-cylinder unit for operation during light loads upon the plant.

Having found its present equipment inadequate to meet the increasing demands for electricity, the Rockland Electric Co. has placed an order with the Westinghouse Machine Co. for two additional 23 x 30-in. two-cylinder double-acting horizontal tandem gas engines. These engines will be of the four-cycle type, imparting two impulses to the crank shaft at each revolution, irrespective of the load. Each will drive a 60-cycle alternating current generator and will operate on producer gas of approximately 125 B. t. u. per cubic foot. The normal rating of each engine will be 470 h.-p., and each will be capable of developing 10 per cent. overload for a period of two hours. After the installation of the two engines now on order, the total capacity of the equipment will approximate 2,100 h.-p.

The gas power plant of the Rockland Electric Company has been in continuous operation during regular working days for nearly a year, supplying current for lighting the surrounding towns, power for adjacent Ramapo Iron Works and fuel gas for a number of heating furnaces. The principal product of the gas plant, water gas, is exclusively used for this purpose on account of its high flame temperature, while power gas is a by-product. Both gases are generated by one system—the Loomis-Pettibone—three complete generating sets being in use. It is frequently the case that the cost of electric current in small suburban communities is prohibitive to a large number of residents, resulting from the high cost of generating steam power; but in this case, owing to the ability of the gas engines to thus turn to useful account a practically waste product, the cost of current is greatly reduced and the cost of an otherwise expensive gas is decreased sufficiently for general manufacturing purpose.

The Billings & Spencer Co., Hartford, Conn., has issued a folder describing the various types of Parker ratchet drills, for boiler makers, track work and other uses where a powerful ratchet drill can be employed.

TESTS OF STEAM SPECIALTIES.

A number of interesting tests of steam specialties were made on Oct. 26 at the works of the Foster Engineering Co., at Newark, under the personal supervision of Mr. H. C. Foster, vice-president and treasurer of the company. Among those present were Admiral J. A. B. Smith, Commanders W. C. Eaton and Albert Moritz, Lieutenant W. B. Day and others from the U. S. Navy; Chas. E. Delanoy, agent of the Harlan & Hollingsworth Co.; J. M. Faris, master mechanic of the Youngstown Iron Sheet & Tube Co.; H. Maxwell Brigham, of Manning, Maxwell & Moore, and others.

The first test was made with one of the company's new type G reducing valves, and its object was to illustrate, first, the delivery of steam at a constant pressure regardless of the variation in the volume of discharge or change in the initial pressure; second, to show that the valve will operate equally well in any position; third, to show that the valve will close tight when no steam is being delivered. In the demonstration a valve was placed in a vertical position on a horizontal pipe. Steam at an initial pressure of 250 lb. was turned on and the valve set to deliver 30 lb. A variable volume of discharge was obtained by opening and closing at intervals four 1½-in. outlets connected in manifold to the discharge pipe, the steam first passing through a small receiving tank. During this test the delivery pressure did not vary one pound. It was then suggested that the receiver be taken off and a 1¼-in. quick-opening valve be placed on the line from the outlet. This was done, but opening and closing this valve did not cause a variation exceeding 2 lb. in the delivery pressure. The same results were obtained with the valve in other positions. The initial pressure was then lowered without affecting the discharge pressure, at variable volumes of discharge, until the initial pressure was within 3 lb. of the discharge. The diaphragm was then removed while steam was passing through the valve, the initial pressure being 250 lb. and the delivery 60 and 30 lb. The whole operation required less than five minutes. All tension was then taken off the spring, but the valve remained tight.

In the second trial a piston actuated pump governor was tested to illustrate the maintenance of pressure by the speed of the pump. A variable volume of discharge was obtained by connecting a manifold to the discharge of the pump. The pump was speeded up to its maximum capacity, while the discharge was maintained at the predetermined point, 100 lb.

The third test was to illustrate the action of a Class Y reducing valve in reducing from high initial pressure, 1,400 lb. and up, to a low delivery, 140 lb. for the purpose of expelling gases from guns after discharge. An 8-in. iron pipe 20 ft. long was used to illustrate the effect of air admitted to the inlet of the pipe. Oily waste was then placed in the tube and ignited to represent smoke. A quick opening gate valve was installed on the line to the tube from the outlet of the reducing valve and opened suddenly to expel the gas. The result of the test showed that the reducing valve maintained the delivery pressure as required, and the result was satisfactory in the extreme.

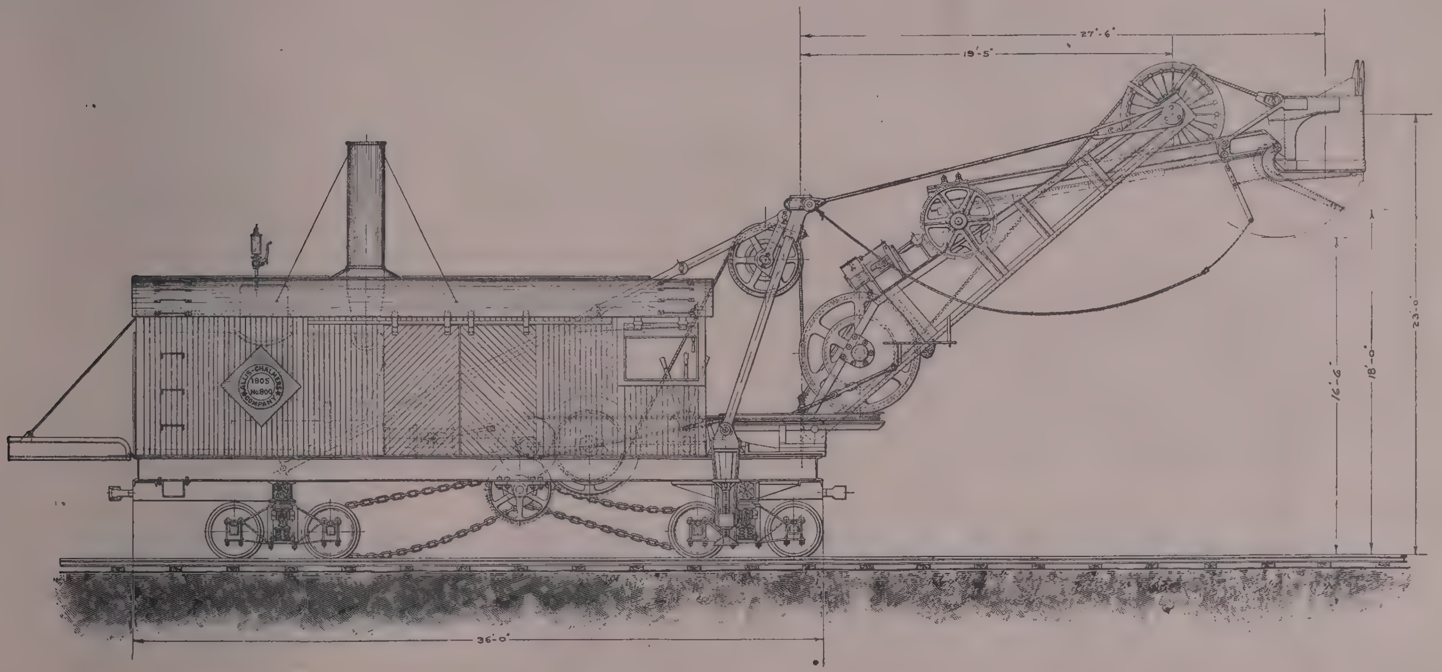
In the fourth test a combination valve was installed on the boiler, the object being to close down in case of a rupture in the steam main. A quick opening gate valve was placed in the line and opened to the atmosphere, which gave the same practical result as of a break in the pipe. In this operation the automatic valve on the boiler closed instantly and shut off steam to the line. The main valve was then closed by opening a small valve in the emergency line to illustrate emergency closing, with the same satisfactory result.

The fifth test was to illustrate the use of the automatic safety stop valve in connection with steam lines whereby the rupture of one line will close the valve and shut off steam from that particular line, without shutting down the whole plant. The same quick opening gate valve as in the combination valve test was used, with the result that the automatic safety stop valve instantly closed down.

THE ALLIS-CHALMERS STEAM SHOVEL.

In the new steam shovel of the Allis-Chalmers Co., of which a side elevation is given in the accompanying cut, the hoisting drum is geared directly to a hoisting engine, doing away with all jack-shafts and their attendant friction. From the hoisting drum the rope runs over a large sheave suspended from the A-frame to a differential drum located on the boom. This differential drum is made up of a drum of large diameter, with a drum of smaller diameter rigidly attached to each side, the smaller drums having the same diameter. This makes a drum with one diameter of, say, 7 ft., and two drums of, say, 3½ ft. each. The rope passes a sufficient number of times around the larger diameter of the differential drum, the end being permanently attached. From the small diameters of the differential drum two ropes lead to the dipper over the head sheave. These ropes are fastened to the drum. Winding the rope on the hoisting drum will cause the hoisting rope to run off the larger diameter of the differential drum and the two ropes attached to the dipper to wind onto the smaller drums. This makes a step-up in the pull exerted, without the use of jack-shaft gearing. The rope running from the large sheave suspended from the A-frame to the large diameter of the differential drum is centrally located over the axis of the turn-table, so that the twist of the rope takes care of the turning without any trouble, doing away with the necessity for guide pulleys. When the digging strains are exerted, the tendency of the ropes between the sheave at the head of the boom and the sheave attached to the A-frame is to straighten, and that tendency exerts an upward pull on the differential drum and lower end of the boom, thus relieving the turn-table of weight. The makers state that the weight removed from this member by this form of construction and method of operating is about 15 tons when the shovel is digging, and 7 tons when the shovel is empty, which is no small matter to be swinging around from two to four times a minute. These figures are based on a three-yard shovel.

The size of rope required to stand the digging strain exerted at the shovel when a direct lift is employed is so great as to necessitate large diameter sheaves to make its use possible. Take, as an instance, 2-in. plow steel rope, which should never be used on a sheave of less diameter than 8 ft. To give a reasonable length of lift to the rope, this would be able to work with 74,000 lbs. strain. By using two ropes of 1⅜-in. diameter the same strength would exist, and sheaves 5 ft. in diameter be perfectly proper. The construction makes the use of two ropes from the differential drum on the boom to the dipper, the best method, and, as the drum increases the power of the rope that runs onto the larger diameter about two-fold, it is possible to use a single rope on the hoisting drum of the same diameter as either of the ropes that run from the small diameter of the drums to the dipper, with good results.



THE NEW ROPE-OPERATED SHOVEL OF THE ALLIS-CHALMERS COMPANY.

The dipper is directly connected to hoisting rope without the use of a bail, which gives a large clear opening for the admission of the material. This makes it possible to lift a full load without its being "struck" by the bail and losing part of its contents, and admits of a higher lift. That method of fastening also reduces the necessary length of the boom to accomplish the most desirable results.

The engines are of a larger size than those usually furnished for shovels of the same capacity. For example the 65-ton shovel has 12 x 12-in. engines making 161 r.p.m. The boiler has a double riveted shell with a fusible plug in the crown sheet and is designed for 100 lb. working pressure. Rocking grates are placed in the firebox and directly under the latter is an ash chute, arranged so that the ashes can be dumped by pulling a lever. This combination makes it unnecessary for the fireman to open the fire-door for any other purpose than to renew the fire.

The A-frame uprights with the jack-arms form a support for the boom that relieves the car of all strains. The A-frame is a single forging capped at the upper end with a cast-steel head.

It is self-evident that weight on the boom, or turntable, is detrimental, so it is good practice to burden this member only with what is absolutely necessary. In line with such a simple deduction the ropes are led so that the strains produce a lifting effect at the foot of the boom, and the engines are put on the car, as the builders can secure all possible speed, avoid unnecessary sheaves, get a direct pull on the shovel, secure a high lift and long reach, and do away with a great quantity of gearing by simple and strong devices, without a material departure from the usual method. By following this course a shovel has been designed in which rapid swinging can be done without serious strains or expensive friction.

The shovel is moved by chains connected to the forward and rear axles from suitable driving mechanism. Provisions are made for releasing this mechanism, so that the car runs free when being moved by the locomotive or in transit.

BUSINESS NOTES.

The New Process Raw Hide Co., Syracuse, N. Y., has announced its intention of going more extensively into the manufacture of metal gears of all kinds as well as its well-known "New Process" noiseless pinions. In furtherance of this plan the company has just completed a 2-story brick addition containing about 10,000 ft. of floor space and is installing a number of additional turret lathes, drills, grinders, spur gear cutters, bevel gear planers and other machinery necessary for the manufacture of accurate gearing. This additional equipment will increase the company's capacity about 75 per cent. Business with this concern is very brisk and it reports shipments as considerable in excess of last year, with prospects very bright for a continuance of the same conditions.

The Thomson Meter Co., 83 Washington St., Brooklyn, had manufactured and sold 286,152 water meters up to Nov. 1.

The Fawcus Machine Co., Pittsburg, has completed an addition to its plant both in the way of buildings and machinery which practically doubles its capacity, and with this addition it has been obliged to continue working day and night to fill orders for gearing, bridge machinery and special work. It has therefore secured an additional piece of property alongside the present ground and plans are now being prepared for another two-story machine shop building 120 ft. long with offices and warerooms on the second floor. The company's business includes not only cut gears of every description, but also general machinery for rolling mills, axle manufactories, glass manufactories, bridges, sugar crystallizers, etc.

The S. Morgan Smith Co., of York, Pa., has recently furnished two horizontal water wheels to the Lombard Governor Co., at Ashland, Mass. These wheels are to be used for supplying power to its factory, and also to be used in connection with testing water wheel governors. The company has recently completed the installation of six turbine water wheels for the Berkshire Power Co., at Canaan, Conn. Each turbine is to develop 120 horse power under 11 feet head. These turbines are installed in sets of three, each three turbines being geared to a jack shaft which is coupled directly to an electrical generator.

The Yampa Smelting Co. have just closed a contract with the Allis Chalmers Co. for six McDougall furnaces, to be installed in the Salt Lake City plant. Each furnace will have six superimposed hearths, each with its sets of rabble arms and rakes. The furnaces are all of large size, measuring 18 ft., outside diameter. The Nevada Consolidated Copper Co., of Nevada, has also closed a contract with the Allis-Chalmers Co. for a battery of six large-size furnaces, each with six hearths.

The Chicago Pneumatic Tool Co.'s statement for the quarter year ending Sept. 30 shows profits for the quarter of $241,791.45. The depreciation, charges and experimental work were $32,488.29, the bond interest and sinking fund reserve $41,250 and dividends, $61,137.83, leaving $106,915.33 to be carried to surplus. The surplus from 1904, less appropriations on account of development work and written off, was $225,437.31. The surplus for the first half of 1905 was $151,460.86. The total surplus on Sept. 30 was $483,813.50.

PERSONAL NOTES.

Mr. F. P. Jones has been appointed general manager of the Dominion Iron & Steel Co.

Mr. R. C. Johnson has been appointed division engineer of the Tidewater Ry., at Norfolk, Va.

Mr. J. G. Gwyn has been appointed assistant chief engineer of the Denver & Rio Grande Ry., at Denver, Colo.

Mr. J. B. Berry has resigned the office of chief engineer of the Union Pacific Ry. to become chief engineer of the Chicago, Rock Island & Pacific Ry. on Nov. 10.

Messrs. Burns & McDonnell, consulting civil engineers of Kansas City, Mo., have moved their offices into larger quarters at the Dwight Bldg.

Mr. Walter S. Woods, city engineer of La Crosse, has been appointed a member of the executive committee of the Upper Mississippi River Improvement Association

Mr. F. T. Darrow has been appointed engineer of maintenance of way in the Nebraska district of the Chicago, Burlington & Quincy Ry., with headquarters at Lincoln.

At the regular meeting of the Brooklyn Engineers' Club, on Nov. 9, Mr. Henry W. Woodcock will read a paper on the Brooklyn Grade Crossing Commission and its work.

Mr. Arthur Warren has resigned his position as manager of publicity for Allis-Chalmers Co., and will sail for Europe on a journalistic mission about the end of November.

Mr. A. C. Dennis has been appointed division engineer of the Prairie East Division, Grand Trunk Pacific Ry., with headquarters at Winnipeg, succeeding the late E. R. McNeill.

Mr. C. P. A. Lonergan, assistant engineer on the Oregon Short Line R. R., has been made engineer in charge of the construction of the new shops of that road at Pocatello, Idaho.

Mr. Arthur McGuire has been appointed chief engineer, and Mr. John Conway, superintendent of construction, of the Las Vegas & Tonopah Ry., a branch of the San Pedro, Los Angeles & Salt Lake Ry.

Mr. Edward Gagel has been promoted to the office of chief engineer of the New York, New Haven & Hartford R. R., succeeding Mr. Ingersoll, who was recently put in charge of the department of real estate, taxes and law.

Capt. Spencer Cosby, Corps of Engineers, U. S. A., has been transferred from San Francisco to the office of the Chief of Engineers. Capt. William J. Barden has been assigned to duty as instructor in the Engineering School at Washington Barracks.

In the description of the works of the Kosmos Portland Cement Co., recently printed in this journal, by an unfortunate oversight no mention was made of the fact that the plant was built under the general engineering supervision of Prof. R. C. Carpenter, of Ithaca, N. Y.

The partnership existing between Messrs. Arthur D. Little and William H. Walker has been dissolved and its business in chemical engineering will be continued by Mr. Little at 93 Broad St., Boston. Mr. Walker will carry on a consulting business as chemical engineer at 24 Trinity Pl., Boston.

The work of supervising the plans for all public school buildings in New Jersey has been taken over by the newly organized State Department of Charities and Correction. Mr. George E. Poole, assistant commissioner of the department, who is a licensed architect, will be in immediate charge of the work.

The late eorge W. Catt, president of the Atlantic, Gulf & Pacific Co., bequeathed his engineering library to the Iowa State College, and one-half his residuary estate will go to the college, on the death of his widow, as a fund to furnish scholarships to deserving students who have completed their freshman year.

Mr. Henry A. La Chicotte has been reinstated in his position as principal assistant engineer of the Department of Bridges of New York City, by Judge Leventritt, of the Supreme Court of the State. The position was abolished as unnecessary about a year ago. The law provides that a city employe holding a place under civil service rules can only be removed when the position becomes unnecessary or the individual's incompetency or unfitness is proved. The jury decided that the position is necessary and Mr. La Chicotte is in no way unfitted for it.

Frank E. Kidder, Ph. D., a valued contributor to this journal and an author of several useful books on architectural engineering, died in Denver, on Oct. 27, from the effects of an operation. He was born in Bangor, Me., in 1859, and was graduated from the Maine State College in 1879, afterward studying at Cornell University and the Massachusetts Institute of Technology. He practiced architecture for a few years in Boston and New York, but for the last sixteen years lived in Denver. His best-known books are "Architect's and Builder's Pocket Book," "Churches and Chapels" and "Building Construction and Superintendence."

Major John Byrne, who died on Tuesday, at Mamaroneck, of pneumonia, was born in Maryland about sixty years ago. After serving through the Civil War he studied civil engineering and engaged in such work for a time, but his marked ability as a promoter and developer of large propositions led him eventually to become connected with the Pittsburg, Shawmut & Northern R. R. He was chairman of the board of directors of the Shawmut, as well as a director in the Shawmut Mining Co. and the Shawmut Coal & Coke Co. He was a director of the Detroit City Gas Co. and the Kersey Mining Co. and a trustee of the Emigrants' Industrial Savings Bank of New York.

Mr. J. H. Wingate has resigned the office of city engineer of Roanoke, Va., for reasons that are stated very clearly as follows in his letter of resignation: "If it is the policy of your bodies to permit contractors to make their own specifications and perform the work to their own liking, the services of a city engineer are unnecessary, and the expense of maintaining the office is a waste of money, so far as the contract is concerned. I have never, and will never, submit to the work being done under my administration without proper inspection; this is due to myself who am the responsible head of the department, and also to the tax-payers who pay the cost. Is it possible for you to find a man who can do all these things without increasing the cost of running the department? I cannot and therefore tender my resignation to take effect as soon as my successor qualifies, my office is checked and any investigation you desire to be made, is made."

Mr. Virgil G. Bogue, vice-president and chief engineer of the Western Pacific Ry., has created six engineering divisions betwen San Francisco and Salt Lake City, as follows: San Francisco division, San Francisco to Stockton; engineer in charge, John T. Williams, with headquarters in Oakland. Sacramento division, Stockton to Oroville; engineer John T. Williams in temporary charge as far as the Yuba River. North Fork division, Oroville to Spanish Creek; engineer in charge, Emery Oliver, with headquarters at Oroville. Engineer Oliver also has temporary charge from the Yuba River to Oroville. Sierra division, Spanish Creek to Deep Hole, Nev.; engineer in charge, J. Q. Jamieson. Humboldt division, Deep Hole to Elko, Nev.; engineer in charge, Charles Harlowe, with headquarters at Winnemucca, Nev. Salt Lake division, Elko to Salt Lake City; engineer in charge, T. J. Wycke, with headquarters at Salt Lake City. Mr. H. M. McCartney has also been appointed principal assistant engineer, and his duties will be to assist Chief Engineer Bogue with his general office duties in San Francisco.

Mr. J. C. Haveley has been appointed chief clerk of the engineering and construction department, and Mr. J. B. Wallace has been appointed engineer of right of way, with headquarters in San Francisco.

The following candidates for admission to the American Society of Engineers were elected on Nov. 1. As members: Charles A. Bowman, Syracuse, N. Y.; W. W. Colpitts, assistant chief engr., Kansas City, Mexico & Orient Ry., Kansas City, Mo.; Ernest P. Goodrich, chief engr., Bush Co., Ltd., Bush Terminal Co., Bush Terminal R. R. Co., and Bush Land Co., New York City; A. M. Lupfer, chief engr., Spokane & Inland R. R., Spokane, Wash.; P. M. Norboe, Hanford, Cal.; H. F. Peet, city engr., Bloemfontein, South Africa; R. D. Stewart, chief engr., Laramie, Hahn's Peak & Pacific Ry., Laramie, Wyo. As associate members: J. L. Allen, with Barber Asphalt Co., Chicago, Ill.; A. F. Armstrong, engr. on Manila sewer system, acting supt. of water supply and sewers, Manila, P. I.; G. W. Bond, Jr., Hoboken, N. J.; G. H. Brazer, asst. engr., with J. R. Worcester, consulting engineer, Boston, Mass.; S. C. Brown, div. engr., Erie R. R., Jersey City, N. J.; J. T. Burke, asst. engr., U. S. Reclamation Service, Minidoka, Idaho; M C. Couchot, San Francisco, Cal.; W. J. Darrow, engr. with Grand Central architects, New York City; H. L. Dunn, civil engr. and supt. of construction, the Draper Co., Hopedale, Mass.; N. A. Eckart, asst. engr. to California State Board of Prison Directors, San Francisco, Cal.; H. T. Fisher, with Pennsylvania, New York & Long Island R. R., New York City; A. B. Hager, designing engr., American Bridge Co., New York City; Sigvald Johannesson, asst. engr., Pennsylvania R. R. tunnels, North River division, New York City; I. H. Kirby, transitman, Bureau of Sewers, Borough of Brooklyn, New York City; A. B. McDaniel, asst. engr., Pennsylvania, New York & Long Island R. R. Co., New York City; Courtland Nixon, constructing quartermaster, U. S. A., Chattanooga, Tenn.; H. S. Smith, Smith & Welles, Wilkes-Barre, Pa.; James Smith, mgr. and engr. for P. & W. MacLellan, Ltd., Coatzacoalcas, Mexico; W. H. Terrell, chief engr., Proximity Mfg. Co., Greensboro, N. C.; John D. Twiggs, Jr., asst. city engineer, Augusta, Ga.; Francis R. Weller, associated with Henry A. Pressey, Washington, D. C.; B. F. Welton, examining engr., office of Commrs. of Accounts, New York City. As associate: C. A. Holden, Asso. Prof. in Civil Engr., Thayer School of Civil Engineering, and Asst. Prof. Mathematics, Dartmouth College, Hanover, N. H. The following associate members were announced transferred to the grade of member by the Board of Direction: C. M. Ayres, Holt, Ala.; J. M. Braxton, Key West, Fla.; G. H. Clark, New York City; F. L. Ford, Hartford, Conn.; Chas. P. Howard, Charleston, W. Va.; C. L. Keller, Chicago, Ill., W. F. Whitemore, Hoboken, N. J.

Aaron G. Shiffler, who died recently at Williamsport, Pa., was one of the pioneer bridge builders of the country. He was born in 1822, and was almost 83 years old when he died. He began work as a carpenter, and soon drifted into the construction of railway bridges. He constructed a bridge across the West Branch of the Susquehanna River in 1854 for the Philadelphia & Erie R. R., and the following year built one across the North Branch. This business developed and finally he formed a partnership with J. L. Piper, which in time became the Keystone Bridge Co. He retired from bridge construction in 1882 and engaged in farming on the outskirts of Williamsport. So many erroneous statements have been made concerning the organization of the Keystone Bridge Co. that the actual facts of the matter may be stated here. Shiffler was a good manager while Piper was a fair inventor. They worked together in a contractor's gang under the firm name of Stone, Quigley & Co., and did so well that in 1865 Chief Engineer W. H. Wilson, of the Pennsylvania R. R., wrote as follows concerning them: "Messrs. J. L. Piper and A. G. Shiffler have been engaged for the last eight years under my personal observation, and for some years previously, in erecting bridges for the Pennsylvania Railroad Co. The wooden bridges have generally been on the Howe plan; the iron bridges have been constructed in the shops of the company from plans prepared by the Engineering Department, some of them of boiler plate, but most of them on the Pratt plan of truss, with modifications introduced at various times. All the work of raising and completing these bridges has been performed by Messrs. Piper and Shiffler in the most satisfactory manner. It affords me pleasure to recommend them as unsurpassed for promptness, energy and skill by any builders with whom I have had business relations." It was in April of the year this letter was written that the Keystone Bridge Co. was incorporated, the list of organizers including the names of A. G. Shiffler, J. L. Piper, Andrew Carnegie, Walter Katte and James Stewart. As a matter of interest it may be added that Mr. Carnegie paid no cash for his shares, which were given him in return for promotion services. At that time he was connected with the Pennsylvania R. R. and through his influence the president, vice-president and other officers of the railroad, the president of another railroad, two chief engineers and a general superintendent became stockholders, and wrote some strong letters of recommendation of the company's resources and methods. The business developed rapidly, and some of the famous bridges built by it were the Eads bridge at St. Louis, the Plattsmouth bridge of the Burlington R. R., the Point Pleasant bridge of the Ohio Central Ry., the Ohio River bridge of the Cincinnati Southern Ry., and the Raritan Bay bridge of the New York & Long Branch R. R. In 1883, a year after Mr. Shiffler's retirement, the company stated it had constructed over 30 miles of bridges, costing over $23,000,000. In that year the company's buildings covered over 3 acres, and employed over 600 men, exclusive of erection crews, and had over $1,000,000 invested in the business.

CONTRACTING NEWS
OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Guntersville, Ala.—See "Power Plants, Gas and Electricity."

Phoenix, Ariz.—Bids will be received until Nov. 22 by the Comr. Indian Affairs (C. F. Larrabee, Acting Comr.) Washington, D. C., for furnishing and delivering at points to be designated by bidders, 2 125-hp. water tube boilers, 1 vacuum pump, 4,830 ft. pipe, 1,120 ft. radiation, besides a quantity of valves, T's, joints, steam traps, etc.; also about 95,000 brick, 105 bbls. lime and 40 bbls. best Portland cement. For further information apply to C. W. Goodman, Supt., Phoenix.

Argenta (Little Rock), Ark.—See "Power Plants, Gas and Electricity.

Woodland, Cal.—The City Trus. on Oct. 16 are reported to have decided to procure bids for the construction of a steel tower for the water works; it will be about 64 ft. high and cost about $6,000.

Ft. Miley, Cal.—Bids will be received until Nov. 25 by Col. Wm. S. Patten, Asst. Q. M. Genl., U. S. A., San Francisco, for constructing a 100,000-gal. reinforced concrete reservoir at Ft. Miley.

Lincoln, Cal.—It is stated that bids will be received until Nov. 14 by J. Schuler, Town Clk., for furnishing and laying 2,600 ft. of 11-in. U. S. standard guage wrought-iron riveted pipe.

Boulder, Colo.—All bids opened on Oct. 18 for furnishing material and installing a system of mountain water mains have been rejected. The following are the bids submitted for this work:

Holme & Allen Pipe & Constr. Co.—16,500 ft. 24-in. continuous wood stave, $2.46; 6,600 ft. 20-in. continuous wood stave, $1.70; 1,000 ft. 18-in. continuous wood stave, $1.55; 7,300 ft. 16-in. continuous wood stave, $1.60; 1,400 ft. 14-in. steel, $2.55, riveted No. 7 U. S. standard gauge; 1,700 ft. 13-in. steel, $2.45, riveted No. 7 U. S. standard gauge; 2,500 ft. 12-in. "B" steel, $2.22, riveted No. 7 U. S. standard gauge; 1,000 ft. 12-in. "A" steel, $2.57, riveted No. 5 U. S. standard gauge; total, including valves, $81,820.

Bid No. 2 (all the above excepting steel pipe).—1,400 ft. 14-in. steel, $1.83, riveted No. 12 U. S. standard gauge; 1,700 ft. 13-in. steel, $1.75, riveted No. 12 U. S. standard gauge; 2,500 ft. 12-in. steel, $1.65, riveted No. 12 U. S. standard gauge; 1,000 ft. 12-in. steel, $2.34, riveted No. 8 U. S. standard gauge; total, $77,967.

Piper Bros. Constr. Co. bid $108,827; the Pacific Coast Pipe Co. bid for the 25,400 ft. 24, 20, 18 and 10-in. pipe $48,350; the Boulder Iron Co. bid for hauling and laying 37,200 ft. 24, 15 and 12-in. pipe $39,432; Hendrie & Bolthoff Co. bid only for the valves and pig lead.

Ft. Screven, Ga.—Bids will be received by Jos. T. Davidson, Q. M., U. S. A., until Nov. 27, for enlarging pump house and for the installation of boiler and pumps at Ft. Screven, as advertised in The Engineering Record.

Bonners Ferry. Idaho.—Alex. M. Winston, 56 Ziegler Blk., Spokane, Wash., proposes constructing water works at Bonners Ferry, at a cost of about $25,000. No engineer selected as yet.

Minooka, Ill.—M. L. Kaffer, Village Clk., writes in regard to the construction of water works, bids for which were recently rejected, that bids will probably be called for again this winter. Construction will begin in the spring.

Rock Island, Ill.—H. C. Schaffer, City Clk., writes that the contract for pumping engine (bids opened Oct. 2) has been awarded to Snow Steam Pump Works, of Buffalo, N. Y., for $24,990.

**Huntingdon, Ind.*—Philip Hipskind & Co. are reported to have secured the contract for a new receiving reservoir at the water works pumping station (bids opened Oct. 24) for $8,096.

Decatur, Ind.—It is stated that bids will be received until Nov. 7 by the Common Council, for constructing extensions of the water mains. Mack McFeeley, City Clk.

**St. Marys, Ind.*—Contracts for water works extension for the Sisters of Providence, at St. Mary's-of-the-Woods, Ind., have been awarded as follows: 100,000-gal. steel tower and tank to Chicago Bridge & Iron Co., Chicago, Ill.; 2 motor-generator sets and 2 motors to Northern Electric Co.; 2 triplex pumps to Henion & Hubbell, Chicago; 1 Underwriters' fire pump to Fairbanks, Morse & Co., Chicago, Ill.; c. i. pipe and specials to A. M. Ozburn, Chicago, Ill.; wrought iron pipe and fittings, gate valves, check valves, etc., to Kinsey & Mahler Co., Peoria, Ill. Dabney H. Maury, Engr., Peoria, Ill.

**Marlow, Ind. Ter.*—J. R. Rogers, Town Recorder, writes that M. Griffin Oneal, of Dallas, Tex., has secured the contract for the proposed water works improvements, and he is to let the contract for the necessary supplies and machinery.

Independence, Ia.—The City Council is reported to have decided to install the Smedley system of water works.

**State Center, Ia.*—The Des Moines Bridge & Iron Co., of Des Moines, is reported to have secured the contract for erecting a steel tank for the water works, at $2,135.

Burlington, Kan.—The city is reported to have purchased the plant of the Burlington Water Co., for $16,500, and will make improvements to same.

Topeka, Kan.—It is proposed to erect an addition to the boiler house at a cost of $5,000 and laying 3,000 lin. ft. 12-in. water pipe.

Mt. Sterling, Ky.—The pumping station of the water works, located at Howards Creek, is reported to have been destroyed by fire on Oct. 23.

Hammond, La.—Water and drainage bonds amounting to $30,000 are reported sold.

Ft. Williams, Me.—Bids will be received until Nov. 11 by Capt. A. W. Yates, Constr., Q. M., U. S. A., Portland, for the extension of water and sewer lines at Ft. Williams, to include 2 hydrants, 2 manholes and 2 gate valves.

Palmer, Mass.—A committee is stated to have been appointed and will probably be ready to report in the spring, on the question of establishing water works. The question of buying the present plant of the Palmer Water Co. is also reported to be under consideration.

Detroit, Mich.—Benj. F. Guiney, Secy. Bd. Water Comrs., writes that all bids opened on Oct. 30 for water tube boilers have been rejected, on account of irregularities, and new bids will be received up to 12 M. on Nov. 8. The bids received same time for automatic stokers and feed water purifiers for boilers are still under consideration.

Foley, Minn.—See "Power Plants, Gas and Electricity."

**Juarez, Mex.*—The City Council is reported to have on Oct. 25 awarded contracts for water works as follows: To Ketelsen & Degetau, of Chihuahua and Juarez, for furnishing pipe of different sizes and specifications. Richard Keays, of El Paso, Tex., and Juarez, for installing the system throughout the city, including the fire hydrants, valve boxes and other appurtenances, and to The Scott-Rankin Co., of El Paso, Tex., for the pump and the electric motor. These three firms will furnish and install the entire system with the exception of the storage tank. The bids for the tank were rejected as being too high. The city will either advertise again for bids or let the contract privately.

Gibbon, Neb.—C. M. Beck, Village Clk., writes that it is proposed to construct water works at a cost of $15,000. No engineer selected as yet.

Allentown, N. J.—The citizens are reported to have voted Oct. 20 to construct water works.

Kearny, N. J.—It is stated that bids will be received until Nov. 8 by the Clk. of Town Council, for constructing a pipe sewer in Elm St.

Camden, N. J.—This city is in favor of more wells, and with new appropriation, work will probably be done, but at present ways and means are being discussed; the city also wants a reserve air compressor. L. E. Farnham is City Engr.

New York, N. Y.—The Bd. of Estimate and Apportionment at its meeting Oct. 27 approved the plans of the local board of water supply and instructed Corporation Counsel to petition the State Board at once for its consent to the execution of the plans. The action of the Bd. of Estimate practically binds the city to the scheme for tapping the water supply in the Catskills to the extent of 500,000,000 gal. of water daily to be distributed to the different boroughs of the city of New York. The estimated cost of the work is $161,000,000. Of this, however, only $112,000,000 will be needed immediately.

Bids will be received until Nov. 22 by John T. Oakley, Comr. Water, Supply, Gas and Electricity, for furnishing, delivering and laying high-pressure fire service mains and appurtenances in numerous streets, Boro. Manhattan. The time allowed for doing and completing the entire work is 250 working days; the security required for the entire work is $300,000.

Brooklyn, N. Y.—The following are the bids opened on Oct. 25 by John T. Oakley, Comr. Water Supply, Gas and Electricity, for tapping 20 and 30-in. water mains in service, and hauling and setting 6-in. hydrant service mains, fire hydrants and appurtenances in Brooklyn Boro. (Bidders all of Brooklyn): Samuel Ross, $39,805; J. H. Davenport, $34,350; Isaac Harris Co., $34,000; Thos. O. C. Sloane, $31,632, and J. P. Graham, $32,817.50.

Mt. Kisco, N. Y.—The Village President writes that $15,000 bonds have been sold, to be used for the construction of water work. Engineer, Fred. G. Betts.

Troy, N. Y.—Bids will be received until Nov. 6 by Wm. H. Gearin, Compt., for $181,500 additional water works bonds.

Ithaca, N. Y.—The new wells and extension of collecting mains in connection with the artesian water supply are to be done by day labor. Plans are in preparation for a gravity system, which is to be constructed next year. F. L. Getman, Engr. and Supt. Water Wks. Consulting Engr., C. C. Vermeule, 203 Bway, New York, N. Y.

Williamston, N. C.—There is reported to be some talk of installing water works here. Address S. J. Everett, Secy. Business Mens Assoc.

**Greensboro, N. C.*—The S. S. Ordway Co. is reported to have secured the contract for constructing a 20,000,000-gal. reservoir at Reedy Fork for the enlargement of the city water supply for about $40,000.

Belle Fourche, S. D.—Bids were opened on Oct. 26 at the office of the U. S. Reclamation Service, Belle Fourche, for the construction of an earthen dam and appurtenances and 17½ miles of canals, the work being located 12 miles n. e. from Belle Fourche. The bids were submitted on three different schedules, namely, 1, 2 and 3: (*a*) Orman & Crook, Pueblo, Colo.; (*b*) Widell-Finley Co., Mankato, Minn.; (*c*) Callahan Bros. & Katz, Omaha, Neb.; (*d*) Empire Eng. Co. (by L. W. Bates), New York, N. Y. (Raymond T. Walter Engr. in Charge, Belle Fourche):

Schedule No. 1.	*a*	*b*	*c*	*d*
31 acres, preparing surface beneath embankment	$8.25	$10.00	$7.50	$97.00
Earth Excavation—				
18,000 cu. yds. from cut-off trenches, Class A	.30	.25	.25	.15
4,000 cu. yds. from cut-off trenches, Class B	1.25	.40	.75	.20
2,000 cu. yds. from cut-off trenches, Class C	3.00	.60	1.25	.23
6,000 cu. yds. at dam for structures	.50	.50	.25	.42
1,580,000 cu. yds. for dam embankment	.28	.365	.35	.325
35,000 cu. yds. for stripping borrow and gravel pits	.16	.18	.25	.33
30,000 cu. yds. trimming dam embankment	.30	.25	.25	.41
22,000 cu. yds. gravel for roadways and on dam	3.75	1.40	1.75	2.65
22,000 cu. yds. screened gravel under concrete	4.00	1.50	2.00	3.15
15 acres soil dressing, seeding, and caring for emb'km't	30.00	200.00	800.00	1,630.00
450 round wooden piles in place	11.44	9.00	4.50	10.90
Grading—				
230,000 cu. yds., Class A	.20	.199	.18	.20
25,000 cu. yds., Class B	.42	.35	.40	.40
1,000 cu. yds., Class C	1.05	1.00	1.00	.80
10,000 cu. yds. overhaul	.02	.01	.02	.015
Concrete Masonry—				
15,000 cu. yds., Class A	7.00	6.70	9.50	8.50
1,700 cu. yds., Class B	6.80	6.95	10.00	7.90
1,850 cu. yds., Class C	6.50	6.75	12.50	7.90
280 cu. yds., Class D	6.80	7.50	12.50	7.90
3,100 cu. yds., Class F	6.80	10.00	10.00	8.30
2,000 cu. yds. gravel, screened and washed	3.60	.25	2.00	3.40
Sluice gates and guides complete, gate stands, shafts (lump sum)	3,575.00	3,600.00	6,000.00	6,800.00
16,000 lbs. cast-iron gates, guides, and stop-plank guides	.085	.058	.07	.23
Sections stop planks, complete (lump sum)	990.00	1,000.00	814.00	1,100.00
2 gatehouses, complete (lump sum)	1,428.00	3,500.00	1,962.00	2,050.00
14,000 lbs. structural steel	.07	.08	.05	.055
25 M. ft. timber, in place	39.00	40.00	22.00	62.00
300 lin. ft. 12-in. vitr. pipe	.60	5.00	.70	1.20
Total	$879.164	$896,892	$962,597	$967,436

Schedule No. 2.	*a*	*d*	*b*	*c*
2,000 cu. yds, earth excav. for stripping borrow pits	$0.15	$0.19	$0.18	$0.20
100 cu. yds. unscreened gravel for roadways	3.85	3.90	1.40	3.00
100 cu. yds. screened gravel under concrete	3.85	4.40	1.50	3.50
330,000 cu. yds. grading, Class A	.165	.175	.18	.25
10,000 cu. yds. grading, Class B	.39	.40	.35	.40
1,090 cu. yds. grading, Class C	1.05	.80	1.00	1.00
150,000 cu. yds. overhaul	.02	.0125	.0125	.01
43 acres preparing surface for canal emb'km'ts	8.25	80.00	10.00	10.00
20,000 cu. yds. earth excav. from borrow pits	.165	.15	.18	.25
500 cu. yds. concrete masonry, Class E	7.25	7.90	10.00	15.00
2,000 lbs. structural steel	.07	.046	.09	.07
400 lin. ft. 12-in. vitr. pipe	.60	1.00	5.00	1.00
Total	$71,130	$76,517	$77,635	$103,520

Schedule No. 3.	*a*	*d*	*b*	*c*
4,000 cu. yds. earth excav. for striping borrow pits	$0.15	$0.19	$0.18	$0.20
100 cu. yds. unscreened gravel for roadway	3.85	3.90	1.40	3.00
100 cu. yds. screened gravel under concrete	3.85	4.40	1.50	3.50
215,000 cu. yds. grading, Class A	.165	.175	.19	.25
14,000 cu. yds. grading, Class B	.39	.40	.35	.40
1,000 cu. yds. grading, Class C	.99	.80	1.00	1.00
130,000 cu. yds. overhaul	.02	.0125	.0125	.01
24 acres preparing surface under canal emb'km't	8.25	30.00	10.00	10.00
25,000 cu. yds. earth excav. from borrow pits	.165	.15	.18	.25
350 cu. yds. concrete masonry, Class E	7.25	7.90	10.00	15.00
1,000 lbs. structural steel	.07	.046	.09	.05
300 lin. ft. 12-in. vitr. pipe	.60	1.00	5.00	1.00
Total	$53,005	$56,021	$59,215	$75,190

**Items marked thus give the names of parties awarded contracts.*

Findlay, O.—Plans are being prepared for the water works improvements and bids will probably be called for about March or April. J. H. Twining, Supt. and Secy. Bd. Pub. Service.

Cincinnati, O.—The F. H. Kirchner & Co., of Cincinnati, are reported to have secured the contract for the construction of filter, coagulation basins and clear water reservoir with pipe lines, valve chambers and miscellaneous works (bids opened Sept. 29 by the Bd. of Trus. Comrs. of Water Wks.) for $487,566. For list of bids received for this work, see issue of The Engineering Record of Oct. 7.

Toledo, O.—The State Bd. of Health on Oct. 26 adopted the plans of the Norwood Eng. Co., of Florence, Mass., for the construction of the water purification works, to cost $483,327, to be completed in 700 days. This company secured the contract for this work, bids for which were opened on Oct. 10 by the Bd. of Public Service.

Bucyrus, O.—The State Bd. of Health on Oct. 25 approved plans for a water filtration system at Bucyrus.

Columbus, O.—The State Bd. of Health on Oct. 25 approved the detailed plans for both the sewage disposal plant and the water filtration plant for Columbus. This will allow the work to proceed without further delay.

Klamath Falls, Ore.—Bids will be received at the office of the U. S. Reclamation Service, Merchants' Exchange Bldg., San Francisco, Cal., until Dec. 29, for the construction of about 9 miles of main canal near Klamath Falls, with head works, sluice gates, bridges and other appurtenances, as advertised in The Engineering Record.

Portland, Ore.—Bids will be received until Nov. 27 by the Water Bd. for furnishing and delivering at Portland about 4,195 tons of 16, 20 and 24-in. c. i. pipe, and 166,000 lbs. of special castings for c. i. pipe, as advertised in The Engineering Record.

Rural Valley, Pa.—Plans are reported to have been completed for the construction of water works.

Lebanon, Pa.—Bids are wanted until Nov. 16 for furnishing material and constructing water works for the township of West Lebanon, as advertised in The Engineering Record.

Hartsville, S. C.—Bids for constructing water works and a sewerage system will probaly be called about Feb. or Mar.; total cost of work, $57,000. Engineer, Chas. C. Wilson, Columbia.

Bristol, Tenn.—T. J. Bunow, City Recorder, writes that citizens will probably vote within the next 30 days on the question of purchasing the plant of the Bristol-Goodson Water Co., for $150,000. If purchased, it is proposed to extend the system at a cost of $100,000.

Nashville, Tenn.—John T. Ahearn, Supt. Water Wks., is reported to have submitted to the Bd. of Pub. Wks. a report on the cost of a plant for supplying West Nashville with water, including a 500,000-gal. pump, a 500,000-gal. tank and laying about 13,000 ft. of 18-in. and 4,000 ft. 24-in. pipe, at $66,942.

Lawrenceburg, Tenn.—See "Power Plants, Gas and Electricity."

Oak Cliff (Dallas), Tex.—The citizens are reported to be considering the issue of bonds for purchasing the water works and improving same.

Ft. Worth, Tex.—The Arlington Heights Water Co. of Ft. Worth and Arlington Heights has been incorporated, with a capital of $50,000, for the purpose of supplying water to the public. Incorporators: L. C. Cole, G. E. Montgomery and Tom D. Cole, Ft. Worth; W. R. Egnle, Defiance, O., and A. V. Baumann, Sandusky, O.

Austin, Tex.—The International & Great Northern R. R. Co. (J. D. Trammel, Ch. Engr., Palestine) is reported to be considering the installation of a water plant at Austin.

Waco, Tex.—The North Waco Artesian Water Co., of Waco, is reported organized with a capital of $5,000, to supply water. Incorporators: L. P. Mills, S. Arcenhold and John Sleeper.

**Pleasant Grove, Utah.*—Contracts for water works construction (bids opened Oct. 12) are stated to have been awarded as follows: Wooden pipe to Handley & Ritchie, of Idaho Falls, Idaho, and iron pipe to Crane & Co., Salt Lake City. The city will do the trench work.

Salt Lake City, Utah.—Bids will be received until Nov. 9 by the Bd. Pub. Wks. (C. A. Wall, Chmn.) for constructing a brick and concrete conduit to replace a portion of the Jordan and Salt Lake City Canal. Approximate quantities of work to be done are as follows: 2,000 cu. yds. excav. and backfill; removing wooden flume, 2,400 lin. ft.; 2,000 lin. ft. brick conduit; 1,000 lin. ft. concrete conduit; 1,000 lin. ft. 8-in. pipe and 6 manholes.

Norfolk, Va.—Bids will be received until Nov. 10 by the Q. M., U. S. Marine Corps, U. S. A., for constructing at the Marine Barracks, Navy Yard, Norfolk, a water system, including rain water cistern, pumps, fire and drainage systems.

North Bennington, Vt.—A committee has been appointed to investigate and make report on the estimated cost of supplying the village with water. C. D. Phillips, Village Clk.

**Richmond, Va.*—The following are the totals of bids received on Oct. 16, also unit prices on some of the items required for constructing a 5-ft. reinforced conduit about 1 mile long with pipe connections: (*a*) Shailer & McCormick, 304 Paddock Bldg., Boston, Mass., $79,341; (*b*) Thos. A. Barry & Co., Richmond, $86,978, and (*c*) Crouse Constr. Co., Perth Amboy, N. J., $54,730 (recommended for award):

	a	*b*	* *c*
2,417 cu. yds. 5-ft. conduit	$24.00	$23.50	$17.00
55 lin. ft. 4-ft. c.-i. main	16.00	16.00	14.25
330 lin. ft. 2½-ft. c.-i. main	9.50	8.00	6.75
300 cu. yds. concrete in foundation	7.50	9.00	5.97
70 lin. ft. excav. & furnishing bends and caulking 36-in. c.-i. pipe	7.50	11.00	7.98
2,643 cu. yds. rip rap	2.50	3.10	2.10
3,833 cu. yds. earth excav. & refill	1.75	3.50	.45
150 cu. yds. loose rock excav. & refill	2.00	1.50	.60
130 cu. yds. solid rock excav. & refill	2.75	3.50	2.50

Burlington, Vt.—The Special Committee, with John B. Wheeler, Chmn., and F. E. Clark, Secy., appointed to consider the improvement of the water supply, has submitted its report, in which it recommends the construction of a filtration plant on the hill, at a cost of $58,000. F. O. Sinclair, City Engr.

Sunnyside, Wash.—Wm. B. Bridgman, Mayor, writes that if the ordinance for the construction of water works is ratified by the people, bids for construction will be called for about Nov. 20; probable cost $12,000. Engineer, O. L. Waller, of Pullman.

Chinook, Wash.—The Chinook Light, Power & Water Co. (Albion Gile, Pres.) proposes constructing water works for Chinook; probable cost, $10,000.

Vancouver Barracks, Wash.—Bids will be received until Nov. 22 by the Constr. Q. M., U. S. A., for the extension of the water supply and sewerage systems at this Post.

Ft. Walla Walla, Wash.—Bids will be received until Nov. 9 by Noble H. Creager, Q. M., U. S. A., for installing water mains, etc., at this post.

**Seattle, Wash.*—The contract for laying a water main in Westlake Ave. (bids opened Oct. 21) has been awarded to the International Contr. Co., 738 New York Blk., for $8,664.

Port Washington, Wis.—See "Power Plants, Gas and Electricity."

Lander, Wyo.—The Town Council is reported to have decided to submit to a vote the proposition to bond the city for the construction of water works and a sewerage system.

Montreal, Que.—There is reported to be a movement on foot among members of City Council to apply to Legislature at its coming session, for permission to borrow money for the purpose of enlarging the aqueduct, for an increase of the water supply. It will probably cost about $2,000,000.

Toronto, Ont.—Bids will be received until Nov. 7 by Thos. Urquhart (Mayor) Chmn. Bd. Control, for additions, etc., to the high level pumping station, including excavation and masonry, etc.; steel and iron work; carpentry; galvanized iron work, etc.

SEWAGE AND SEWERAGE DISPOSAL

Notes Arranged Alphabetically by States.

West Hartford, Conn.—This town will probably construct the Central District sewer next Spring. The work will involve the construction of about 2½ miles of trunk sewer with several miles of laterals. Algeron B. Alderson, Town Engr.

Redding, Cal.—See "Public Buildings."

**Washington, D. C.*—Lieut. Col. R. L. Hoxie, Corps Engrs., U. S. A., writes that Martin McNamara, of Washington, has secured the contract for constructing terra cotta pipe sewers, catch basins and manholes in the Washington approach to highway bridge across Potomac River (bids opened Oct. 20) for $2,844.

Live Oak, Fla.—Wm. W. Lyon, of Palatka, has been selected to make surveys and plans and superintend the construction of a sanitary sewerage system; approximate cost, $35,000.

Boise, Idaho.—Specifications are on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y., for the construction of lateral sewers, manholes, flush tanks, flush line and appurtenances in Lateral Sewers Districts Nos. 101 and 102, bids for which will be received by the Mayor and Common Council on Nov. 9. There will be required for this work, 26,337 lin. ft. 8-in. and 1,600 lin. ft. 10-in. vitr. pipe, not including Y's; 107 manholes, 1 flush line with settling basin, 19 flushing connections with manholes, about 150 Y's 10 x 6-in. and about 1,500 Y's 8 x 6-in. J. A. Beal, City Clk., Zenas N. Vaughn, City Engr.

East St. Louis, Ill.—W. J. Crocken, City Engr., is preparing plans for improving 15th St. from St. Clair Ave. to the city limits about ¾ of a mile. The street will be paved with vitrified brick and sewered with vitrified pipe.

Elgin, Ill.—Henry Dakin, City Engr., writes that the proposed sewer in the 4th ward will be of brick and vitrified pipe, but nothing definite has yet been done.

Wilmette, Ill.—C. N. Roberts is reported to be preparing plans for a drainage system for the city. E. P. Dunshee, Secy. Bd. Local Improv.

Alton, Ill.—The City Council has passed ordinances providing for the construction of about 4 miles of sewers, at an estimated cost of $44,000.

Geneva, Ill.—A preliminary survey is reported to have been started for the construction of a sewerage system here; it will be about 4,000 ft. in length, and empty into Fox River. Oroville Peckham, of Geneva, is reported interested.

Huntington, Ind.—The City Council is reported to have decided to construct a sewer on Salamonie Ave., at a cost of $24,425. H. H. Wagoner, City Engr.

Warsaw, Ind.—The City Council is reported to have ordered plans and specifications prepared for the construction of a sewer on Main St.

Clinton, Ia.—The lowest bid opened on Oct. 25 for the construction of sewers in District No. 4 is stated to have been submitted by C. M. Porter, of Chicago, Ill., at $168,915.

**Waterloo, Ia.*—C. Wilson, City Engr., writes that the following are the bids opened on Oct. 23 by the City Clk. for the construction of sewers: (*a*) W. A. Edgar, Cedar Rapids, $19,865 (awarded contract); (*b*) M. Ford, Cedar Radips, $20,188; (*c*) R. C. De La Hunt, Cedar Rapids, $21,016, and (*d*) King-Lambert Constr. Co., $21,890:

	**a*	*b*	*c*	*d*
Concrete and brick sewer—				
1,900 ft. 36-in.	$4.50	$4.74	$4.75	$5.37
440 ft. 30-in.	...	3.21	...	3.91
Pipe sewers—				
1,900 ft. 36-in.	5.95	...	...	...
440 ft. 30-in.	3.23	4.50	3.60	...
3,000 ft. 24-in.	2.60	2.74	2.62	2.65
552 ft. 15-in.	1.50	.95	1.55	1.40
672 ft. 10-in.	1.00	.80	1.25	1.00
650 ft. 8-in.	.90	.75	1.25	.88
Manholes, each	40.00	40.00	45.00	53.00

Des Moines, Ia.—Bids will be received until Nov. 16 by the Bd. Pub. Wks. (W. W. Wise, Chmn.) for constructing about 1,025 lin. ft. 15-in. vitr. clay pipe sewer in a portion of E. J St.; also 655 lin. ft. 12-in. in W. 11th and W. 25th Sts.

Ft. Williams, Me.—See "Water."

Milford, Mass.—It is reported that the cost, under the Bowditch system of extending the sewer from where it empties into the Charles River on Pond St., to a point below the plant of the Milford Rubber Co. on Central St., will be about $267,000. This would include the cost of filtration beds and other necessities for the disposal of the sewage. Dr. Geo. B. Crooke, Chmn. Sewage Com.

Boston, Mass.—The following are reported to be the bids received for the construction of the Talbot Ave. Sewer, Sects. 5 and 6 (*a*) for Sect. 5, opened Oct. 26, (*b*) for Sect. 6 opened Oct. 27: A. Cefalo, *a* $22,148; J. H. Ferguson, *a* $21,370; Geo. M. Bryne Co., *a* $18,975, *b* $12,804; Dan'l E. Lynch, *a* $18,315, *b* 11,583 T. J. O'Connell, *a* $18,004, *b* $10,032; Metropolitan Constr. Co., *a* $17,178; D. E. Coleman, *a* $15,348, *b* $10,916; P. W. Hill, 141 Canton St., *a* $14,415, *b* $8,161; W. P. Barry, *a* $14,312, *b* $11,220; F. A. Foster & Co., 34 School St., $13,581, *b* $9,987; Jas. D. Fallon, *b* $11,847; McBride & Co., *b* $9,507.

Rivet Rouge, Mich.—John Cassidy, Jr., Village Clk., writes that an election will be held about Dec. 20 to vote on issuing $150,000 bonds for a sewerage system. Engineers, Mason L. Brown & Co., Chamber of Commerce Bldg., Detroit.

Pipestone, Minn.—The City Council is reported to have authorized W. H. Cowan, acting for Loweth & Wolff, Engrs., to superintend the work of sewerage construction.

Albert Lea, Minn.—The following are the totals of bids opened on Oct. 24 by the City Council for the construction of brick and pipe sewers (Wm. Barneck, City Engr.): Illstrup & Olson, Phoenix Bldg., Minneapolis, $21,440; J. W. Turner, 309 Youngerman Blk., Des Moines, Ia., $25,995; O'Neil & Son, Faribault, $27,253, and W. D. Lovell, Minneapolis, $27,835.

St. Charles, Mo.—It is proposed to construct a sewerage system here at a cost of $75,000. Date of receiving bids not yet set. Engineers, Burns & McDonald, Dwight Bldg., Kansas City, Mo.

New York, N. Y.—The following are the bids opened on Oct. 31 by Louis F. Haffen, Pres. Bronx Boro., for constructing sewer in Grand Boule. and Concourse, bet. 183d and 189th St. and in Field Pl.: W. J. Brennan, 1968 Clinton Ave., $11,550; W. J. Ford, 17 W. 103rd St., $16,189; J. H. Kerrigan, 2016 Arthur Ave., $12,668; J. C. Voorhees, 182d St. and Morris Ave., $14,988; M. J. Leahy, 990 E. 156th St., $13,635; Jos. M. Stanton, 1341 Webster Ave., $12,184; Briggs & McLaughlin, 19 E. 130th St., $12,082; Italian-American Eng. Co., 80 Center St., $11,503; Haiduven-Schloss Constr. Co., 177th St. and 3rd Ave., $13,234; McDonald & Russell, 765 Tremont Ave., $11,952, and Culgin & Pace, 177th St. and 3rd Ave., $11,332. The detail bid of Culgin & Pace, the lowest bidders, is as follows: 523 lin. ft. 18-in. pipe sewer, $3.80; 543 lin. ft. 15-in., $3.60; 806 lin. ft. 12-in., $1.45; 21 manholes, ea. $60; 3 receiving basins complete, ea. $150; 1 catch basin $60; 1,140 cu. yds. rock excav. $3.50; 25 cu. yds. concrete $5; 10 M. ft. timber, $30 per M. ft.

Brooklyn, N. Y.—Bids will be received until Nov. 15 by Martin W. Littleton, Pres. Brooklyn Boro., for furnishing material and constructing sewer in Quay St., from East River to West St., etc. The Engineer submitted 3 estimates, known as "A," "B," and "C" and each requiring 1,315 lin. ft. 66-in., 685 lin. ft. 60-in., and 665 lin. ft. 54-in. reinforced concrete sewer; 866 lin. ft. 48-in., 715 lin. ft. 36-in., and 325 lin. ft. 30-in. sewer; 540 lin. ft. 24-in., 660 lin. ft. 18-in., 405 lin. 15-in., and 30 lin. ft. 12-in. pipe sewer; 47 manholes; 1 sewer basin; 312 M. ft. found. planking and pile capping; 220 M. ft. sheeting and bracing; 47,000 lin. ft. piles; 1 sewer-basin reconnected; 179 cu. yds. concrete cradle; 3,950 lin. ft. 12-in. pipe sub-drain. Bids will also be received same time and place for furnishing material and constructing sewer in Bay 8th St., from Benson to Bath Aves., etc. The engineer submitted 3 estimates, "A," "B" and "C," each requiring 455 lin. ft. 42-in. sewer, 45 lin. ft. 15-in., and 700 lin. ft. 12-in. pipe sewer; 12 manholes; 21. M. found. planking and pile capping; 3,500 lin. ft. piles; 53 cu. yds. concrete cradle. Also on same date and place for sewers in portion of several other streets, engineer's

New York, N. Y.—The following are the bids opened on Oct. 31 by Louis F. Haffen, Pres. Bronx Boro., for rebuilding the sewer in E. 149th St., near the N. Y., N. H. & H. R. R. crossing: (*a*) Arthur F. McGuinness, 1568 3rd Ave.; (*b*) Culgin & Pace Co., 177th St. and 3rd Ave.; (*c*) Italian American Eng. Co., 80 Centre St.; (*d*) F. V. Smith Contr. Co., 147 E. 125th St.; (*e*) Jas Pekington, Ft. Washington Park; (*f*) Briggs & McLaughlin, 19 E. 130th St.; (*g*) Cunningham & Kearns, 432 E. 91st St.; (*f*) S. M. De Pasquale, Williamsbridge:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
15,300 cu. yds. of excav	$1.00	$0.74	$0.65	..	$0.50	$1.75	$1.40	$1.04
935 cu. yds. of concrete	8.50	8.50	10.00	20.00	10.00	10.00	8.00	9.25
62,900 lbs. of 1-in. steel bars	.03	.03½	.02¼	.05	.15	.03	.05	.03
8,100 lbs of. ½-in. steel bars	.03	.03½	.02½	.05	.15	.03½	.05	.03
2,000 sq. ft. expanded metal	.05	.04½	.04½	.10	.40	.05	.08	.10
300 lbs. of steel in 10-in. I beam	.03	.04	.04½	.05	.15	.04	.05	.03
50 lin. ft. 12-in. drain pipe	...	1.00	.50	2.00	4.00	1.00	1.00	1.00
120 M. ft. of timber	37.00	40.00	32.00	50.00	75.00	40.00	45.00	40.00
20,000 lin. ft. piles	.35	.30	.35	.20	.15	..	.25	.20
700 cu. yds. broken stone for foundations	2.00	1.50	1.50	2.00	2.00	2.00	1.50	1.25
100 lin. ft. 18-in. drain pipe	..	1.25	1.50	3.00	4.00	1.00	1.00	1.00
25 cu. yds. brick masonry	20.00	15.00	12.00	12.00	25.00	12.00	10.00	8.00
Totals	$38,836	$34,500	$33,394	$34,575	$42,960	$45,069	$44,490	$36,692

**Items marked thus give the names of parties awarded contracts.*

estimate: 5,494 lin. ft. 24, 18, 15 and 12-in. pipe, 53 manholes, 38 M. ft. found. planking, etc.

Brooklyn, N. Y.—See "Miscellaneous."

Niagara Falls, N. Y.—All bids recently received here for the construction of sewers are reported to have been rejected.

Newark, N. Y.——The question of constructing a sewerage system at a cost of $75,000 is reported under consideration.

Elyria, O.—Bids will be received by the Bd. of Pub. Service (Scott Hinman, Clk.) until Nov. 23 for the construction of a trunk sewer and branches, on the east side of the city, as advertised in The Engineering Record; estimated cost, $40,000.

St. Bernard, O.—It is stated that bids will be received until Nov. 8 by Geo. Meyer, Village Clk., for constructing sewers in portions of several streets. J. A. Stewart, Village Engr., Traction Bldg., Cincinnati, O.

Columbus, O.—See "Water."

Reading, Pa.—The only bid received and opened on Oct. 19 by the Bd. of Pub. Wks. for increasing the capacity of the sewage disposal plant at Millmont, was submitted by O. M. Weand, of Reading. He bid for furnishing material and increasing the capacity of the present disposal plant at Millmont to 7,000,000 gal. per 24 hours, complete, for $73,000. He also submitted a bid of $46,000 per year to be paid in monthly installments, for increasing the capacity, maintaining and operating the sewage pumping station and disposal plant for a period of 5 years. The Council is reported to have on Oct. 30 rejected this bid.

Wynnewood, Pa.—The Wynnewood Manor Co. hopes to get the Merion sewers extended to Wynnewood, but if not, a disposal plant will be put in. Engineers, Pugh & Hubbard, Real Estate Trust Bldg., Philadelphia.

**Meyersdale, Pa.*—Herman Thiell & Son, of Johnstown, are reported to have secured the contract for constructing sewers on Bway. for $4,995.

Hartsville, S. C.—See "Water."

**Groton, S. D.*—W. A. Burnham, City Aud., writes that Jones & Roderick, of Canton, have secured the contract for 2,450 ft. 10-in. vitr. pipe sewer at 64¾ cts. per ft. and for manholes, $39 ea.

**Richmond, Va.*—Burton, Maynard & Flood are stated to have secured the contract for the extension of the sewerage system from Bacon, Quarter branch in Henrico County along the Boulevard; probable cost, $72,000.

Tacoma, Wash.—This city will build about 15 miles of sanitary sewer this winter; also 4 miles of 20 to 24-in. trunk sewer to South Tacoma. Frank L. Davis, City Engr.

Vancouver Barracks, Wash.—See "Water."

**Manitowoc, Wis.*—Walter O. Bahr is reported to have secured contracts for sewer works for $40,000.

Lander, Wyo.—See "Water."

Hamilton, Ont.—The manufacturers and aldermen are reported to have agreed on plans for the construction of a sewerage system in the manufacturing district. The City Engineer estimates the cost at $26,000 exclusive of the disposal works, which will cost an additional $30,000. The City Council will shortly submit a by-law to the people. The disposal works will probably not be required for several years, and will not at this time be included in the construction.

BRIDGES.

Notes Arranged Alphabetically by States.

Argenta (Little Rock), Ark.—Bids will be received by A. B. Gerlack, City Clk., until Nov. 10 for the construction of a viaduct; probable cost, $25,000. W. C. Faucette, Mayor.

Chicago, Ill.—Bids will be received until Nov. 9 by the Dept. Pub. Wks. (Jos. M. Patterson, Comr.) for furnishing material and constructing the east approach and approach span for the new Harrison St. Bridge over the south branch of the Chicago River, including the removal of the present old approach and the diverting and reconstruction of the present sewer and connecting same with the outlet already built.

Indianapolis, Ind.—Bids will be received until Nov. 11 by the Bd. Co. Comrs. (John M'Cregor, Chmn.) for constructing a bridge over Fall Creek on 13th St.; also bridge over Canal at Broad Ripple, Washington Township; bids will also be received for rip rap for Buck Creek Bridge on Michigan Road, Franklin Township.

Indianapolis, Ind.—The plans of W. A. Honhorst are stated to have been approved by the County Comrs. for a Melan arch bridge to be constructed over Fall Creek at 30th St. According to reports the contract will soon be let.

**Ashland, Ky.*—The Detroit, Toledo & Ironton and the Ann Arbor R. R. Cos. are stated to have awarded the contract for constructing a bridge over Ohio River between Ironton, O., and Ashland, to the American Bridge Co., 42 Bway., New York, N. Y. The contract price is reported to be about $2,000,000.

Gloucester, Mass.—Plans have been completed and bids will be asked for the construction of a bridge at Gloucester. The superstructure will be of the Scherzer type, 105 ft. long and 45 ft. wide. For further information address the Comrs. of Essex County at Salem.

Boston, Mass.—The following are the bids opened on Oct. 26 by Wm. Jackson, City Engr., for the construction of the steel draw span of Atlantic Ave. Bridge: The Pennsylvania Steel Co., Steelton, Pa., $56,600; Boston Bridge Works, Inc., Boston, $58,965; King Bridge Co., Cleveland, O., $61,900; New Jersey Bridge Co., Fuller Bldg., New York, N. Y., $62,300; Eastern Bridge & Structural Co., Worcester, $64,700; Canton Bridge Co., 147 Mills St., Boston, $64,890; American Bridge Co., of New York, N. Y., and Boston, $65,660, and Groton Bridge Co., Worcester, $68,050.

*The following are the bids opened Oct. 25 by Jas. Donovan, Supt. of Sts., for widening the opening for the passage for vessels at Dover St. Bridge; Geo. H. Cavanagh, Boston, $8,180; W. L. Miller, $7,934; Lawler Bros., Charlestown, $7,610; W. H. Ellis, Boston, $7,465; Cahill Constr. Co., 7 Water St., Boston, $6,502 (awarded contract).

Bids will be received until Nov. 9 by Wm. Jackson, City Engr., for constructing the draw pier of Atlantic Ave. Bridge.

Wright, Minn.—See "Paving and Roadmaking."

Duluth, Minn.—City Engr. McGilvray submitted two plans for repairing the Lake Ave. Viaduct, one by strengthening with steel at a cost of $4,880, the other with the use of concrete, at a cost of $6,000.

Kansas City, Mo.—The Belt Line is stated to have submitted to E. A. Harper, City Engr., plans for a steel viaduct with concrete approaches, in all 990 ft. in length over the tracks at Bway.; estimated cost of proposed structure is $125,000.

Jefferson City, Mo.—The Council has under advisement the construction of a concrete arch, about 400 ft. long with 24-ft. span. E. F. C. Harding, City Engr.

Farmington, Mo.—Bids will be received until Nov. 8 by C. W. Francisco, Co. Surv., for constructing 2 steel bridges, one a 60-ft. span across Big Doe Creek, to have a 12-ft. roadway and stone abutments, the other to be a 30-ft. span over branch at Old Maid's Spring, to have a 14-ft. roadway and stone abutments.

Camden, N. J.—The following are reported to be the bids opened on Oct. 30 by the Bd. of Freeholders for constructing a roller lift bridge over Cooper's Creek at Federal St.: New Jersey Bridge Co., $58,900 and $78,250; The Scherzer Roller Lift Bridge Co., $80,000, $70,000 and $65,000; The West Virginia Bridge & Constr. Co., $95,000.

New York, N. Y.—The Bd. of Estimate is stated to have approved plans as submitted by Wm. A. Pratt, Ch. Engr. for New York, Westchester & Boston Ry. Co., for 8 bridges at various streets along the line. The structures to be steel, concrete or masonry or a combination of these materials.

Columbus, O.—The County Comrs. are stated to have passed the resolution providing for the construction of the Reed Ave. Viaduct.

**Refton, Pa.*—M. G. Schaeffer, County Controller, Lancaster, writes that Chas. Binkle has secured the contract for the masonry work on the new overhead bridge over Big Beaver Creek, near Refton, for $2,475, and the Eyre Constr. Co. secured the contract for the superstructure of the bridge for $1,047.

Scranton, Pa.—Mayor Connell is reported to have approved the resolution permitting the Central R. R. of New Jersey (Jos. O. Osgood, Ch. Engr.) to construct a bridge at W. Linden St.

Denison, Tex.—It is reported that the greater part of the bridges on the Texas lines of the Missouri, Kansas & Texas R. R. will be replaced with heavier and more substantial structures. S. B. Fisher, Ch. Engr.

La Crosse, Wis.—The City Council is stated to have decided to issue $40,000 bonds for constructing a bridge over La Crosse River; also a steel viaduct at Rose St.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Ensley, Ala.—A. L. Arnold, City Clk., writes that it is proposed to construct sidewalks on 20th, 21st and 22d Sts., at a cost of $25,000.

Redding, Cal.—See "Public Buildings."

**Tampa, Fla.*—The Bd. of Public Works is stated to have on Oct. 27 awarded the contract for paving with brick in Tampa to the Georgia Engineering Co., of Augusta, at $1.39 per sq. yd.

**Monmouth, Ill.*—The Bd. of Local Improvements is stated to have awarded the contracts for paving N. 9th St. and N. 3d St.: A. W. Gates receiving the former contract for $8,653 and Tuckey & Merrifield the latter contract for $10,035.

Bloomington, Ill.—Bids will be received until Nov. 10 for resurfacing N. Main St. with asphalt about 11,335 sq. yds. Elmer Folsom, City Engr.

East St. Louis, Ill.—See "Sewerage and Sewage Disposal."

Peoria, Ill.—The Council is stated to have under consideration the paving of Western Ave.

Mooresville, Ind.—It is stated that bids will be received until Nov. 7 by the Bd. Trus. for constructing 2½ miles of concrete sidewalks.

Indianapolis, Ind.—Bids will be received until Nov. 10 by the Bd. Pub. Wks. (M. A. Downing, Pres.) for improving a portion of 24th St., by grading, graveling and rolling the roadway; also 1st St., and constructing a levee in connection therewith.

Terre Haute, Ind.—The citizens of Pierson Township, Vigo County, have voted to construct public highways, at a cost of $50,000.

**Indianapolis, Ind.*—The American Constr. Co. is stated to have secured the contract for paving with brick a portion of Indiana Ave., at $3.74 per sq. yd. Bids opened Oct. 20.

Des Moines, Ia.—Bids will be received until Nov. 16 by the Bd. Pub. Wks. (W. W. Wise, Chmn.) for constructing about 8,072 sq. yds. vitr. brick and concrete pavement on portions of 4 streets.

**Louisville, Ky.*—The Barber Asphalt Paving Co., 347 5th Ave., is stated to have secured the contract for paving with asphalt a portion of Market St., at $1.34 per sq. yd.

Shreveport, La.—Bids are wanted until Nov. 14 for improving about 1,940 sq. yds. of Fairfield Ave., by paving with asphalt or bitulithic. C. G. Rives, Compt.

Towson, Md.—Bids will be received until Nov. 9 by the Co. Highway Comrs. for grading and macadamizing about 4¼ miles Co. roads. H. G. Shirley, Roads Engr.

Grand Rapids, Mich.—The City Engr. is stated to have submitted estimates as follows for paving portions of several streets: Hastings St., with brick, $4,390; Trowbridge St., with brick, $4,680; Fountain St., with asphalt, $24,910, with creosote wood block, $23,645, with bituminous macadam $22,300.

**Detroit, Mich.*—Wm. W. Magee, Secy. Dept. Pub. Wks., writes that Reich Bros., 44 Miami Ave., Detroit, have secured the contract for a brick making plant for $41,550.

Wright, Minn.—Bids will be received until Nov. 27 by the Co. Bd. Superv., of the Town of Besemann (Mans Olsen, Chmn.) for $8,000 bonds for constructing roads and bridges.

Kansas City, Mo.—The Bd. of Park Comrs. is stated to have awarded contracts for paving a portion of Admiral Boule., as follows (price given per sq. yd.): With Creosote block, Fielding & Shepley, of St. Paul, Minn., at $2.53; with bitulithic, Kansas Bithulithic Co., $2.35, and with rock asphalt, R. J. & W. M. Boyd Constr. Co., Heist Bldg., $2.40.

Omaha, Neb.—The following bids are stated to have been opened for paving portions of *a* 19th St., *b* 18th St., and *c* 20th St.: C. E. Fanning, with brick block, *a* $1.76, *b* and *c* $1.93; Hugh Murphy, with brick block, *a* $1.60, *b* and *c*, $1.99; Barber Asphalt Paving Co., with asphalt, *a* $1.73, *b* and *c*, $1.71½, and E. D. Van Court, with macadam (2 bids), $1.20 and 92 cts.

Atlantic City, N. J.—Bids will be received until Nov. 13 by the City Clerk at Council Chambers, for paving Atlantic Ave., as advertised in The Engineering Record. Engineer's estimate: 93,000 sq. yds. Trinidad Lake asphalt pavt., 12,000 sq. yds. vitrified fire clay block pavt., 47,000 cu. yds. excav., 29,300 lin. ft. straight Balfour, N. C., granite curb, etc.

New York, N. Y.—The following are the bids opened on Oct. 31 by Louis F. Haffen, Pres. Bronx Boro., for repaving Brook Ave. from 3d Ave. to 165th St., with wood blocks and granite block: *a* Franklin Contsr. Co., $35,421, *b* U. S. Wood Preserving Co., 29 Bway., $33,446:

	a	*b*
7,425 sq. yds. wood block pavt.	$2.75	$2.63
1,450 cu. yds. concrete	6.25	5.75
1,700 lin. ft. new curb	1.00	.95
1,600 lin. ft. old curb reset	.40	.34
1,820 sq. yds. granite pavt.	2.65	2.60
8,737 sq. yds. old paving blocks purchased and removed	.14	.15

New York, N. Y.—The following are the bids opened on Oct. 26 by the Comrs. of Parks for paving with asphalt the walks in St. Marys Park, Bronx Boro (10,000 sq. yds. asphalt, price given per sq. yd.): Barber Asphalt Paving Co., 114 Liberty St., $1.69; The Sicilian Asphalt Paving Co., 41 Park Row, $1.80, and Vulcanite Paving Co., 114 Liberty St., $1.85.

The following are the bids opened on Oct. 31 by Louis F. Haffen, Pres. Bronx Boro., for regulating, grading, etc. (*a*) Cameron Pl. from Jerome to Morris Ave., (*b*) Eastburn Ave. from E. 175th St. to Belmont St.: J. C. Voorhies, 182d St. and Morris Ave., *a* $7,595; H. Sowdon, *a* $10,315; M. O'Connell, Jr., *a* $10,019.50; D. W. Moran, *a* $7,820, *b* $13,697; Uvalde Asphalt Paving Co., *a* $8,927, *b* $11,198; A. G. Vermilye, *a* $8,300, *b* $14,000; G. I. Bailey, *a* $8,909; M. J. Fitzgerald, *a* $8,278; F. Del Balso, *a* $8,383, *b* $10,699; Haiduven, Schloss Con. Co., *a* $9,312, *b* $12,969; Culgin & Pace Con. Co., *a* $8,417; Italian American Eng. Co., 80 Centre St., *a* $7,913, *b* $10,584; W. F. Murray, *b* $17,631.

The following are the bids opened on Oct. 31 by Louis F. Haffen, Pres. Bronx Boro., for paving with asphalt Lorillard Pl. from 3d to Pelham Ave.: Uvalde Asphalt Co., $14,351; Asphalt Constr. Co., 137th St. and Park Ave., $10,128; Barber Asphalt Paving Co., $11,201. The detail bid of the Asphalt Constr. Co., the lowest bidder, is as follows: 5,750 sq. yds. asphalt, 77 cts.; 1,025 cu. yds. concrete, $4.25; 500 lin. ft. new curb, 80 cts., and 2,950 lin. ft. old curb, 32 cts.

The Mayor and Bd. of Aldermen have approved the ordinance providing for the issue of Corporate stock amounting to $200,000 for repaving streets and avenues throughout Boro. of Manhattan.

Bids will be received until Nov. 9 by the Park Bd. (Saml. Parsons, Jr., Pres.) for furnishing materials and constructing sidewalks of rock, asphalt, mastic and Portland cement mortar on Cathederal Parkway and Plaza, at 110th St. and 5th Ave., all in Boro. Manhattan.

Brooklyn, N. Y.—Bids will be received until Nov. 15 by Martin W. Littleton, Boro. Pres., for regulating, grading, paving, repaving and laying sidewalks on portions of several streets. Engineer's estimate: 13,210 sq. yds. asphalt pavt.; 2,635 yds. Medina stone pavt., with cement joints; 26,750 sq. ft. cement sidewalks; 15,501 lin. ft. new curb; 3,105 lin. ft. concrete curb; 2,815 cu. yds. concrete; 10,172 cu. yds. earth excav., 21 noiseless covers and heads, complete, for sewer manholes, etc.

Delaware, O.—Bids will be received until Nov. 30 at the office of F. D. King. City Aud., for improving a portion of Catherine St. and Pennsylvania Ave., by grading, curbing and macadamizing.

Cleveland, O.—Bids will be received at the office of A. R. Callow, Secy. Bd. Pub. Service, until Nov. 8, for improving a portion of Bway. by grading, curbing and repaving with dressed block Medina stone.

**Kent, O.*—The contract for paving W. Main St. is reported to have been awarded to Wildes & Davidson, of Akron, for $20,557.

**Springfield, O.*—J. T. McClure is reported to have secured the contract for paving with brick a portion of

New York, N. Y.—The following are the bids opened on Oct. 31 by Louis F. Haffen, Pres. Bronx Boro., for regulating, flagging, etc., Longfellow Ave. from Westchester Ave. to Boston Road: (*a*) D. W. Moran, $40,113; (*b*) J. C. Voorhies, $36,366; (*c*) M. J. Leahy, $38,676; (*d*) G. I. Bailey, $34,529; (*e*) P. J. Kane, $37,032; (*f*) F. Del Balso, $34,096; (*g*) F. V. Smith Contr. Co., 125th and Lexington Ave., $31,000; (*h*) Troy Public Works Co., $37,076; (*i*) McDonald & Russell, $40,820; (*j*) Haiduyen, Schloss Con. Co., $38,384; (*k*) W. F. Murray, $38,211; (*l*) Italian-American Eng. Co., $41,392.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
15,100 cu. yds. earth excav.	$.80	$.75	$.75	$.50	$.60	$.55	$.45	$.60	$1.26	$.75	$.71	$1.05
6,050 cu. yds. rock excav.	1.80	1.65	1.75	1.73	1.75	1.60	1.38	1.60	1.36	1.60	1.40	1.40
9,100 lin. ft. new curb	.73	.65	.67	.71	.78	.73	.70	.80	.70	.85	.99	.70
36,900 sq. ft. new flag	.25	.20	.23	.23	.26	.24	.21	.25	.15	.24	.22	.25
1,675 sq. ft. new bridgestone	.50	.65	.60	.50	.55	.50	.50	.60	.45	.30	.50	.55
450 cu. yds. dry rubble masonry	.75	1.50	2.50	1.50	1.25	1.50	2.00	1.50	1.00	.50	1.90	1.00
100 lin. ft. 12-in. vitr. pipe	1.00	..	.50	.01	.58	..	..	1.00	1.00	.10	1.50	.50

**Items marked thus give the names of parties awarded contracts.*

Factory St., at $4,687. Bids opened Oct. 12.

**Cincinnati, O.*—The Kirchner Constr. Co., 8th and Plum Sts., is reported to have secured the contract for paving with bitulithic a portion of Lytle St., for $3,392.

Bids will be received until Nov. 23 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing material and improving a portion of Hopkins St., by grading, curbing and paving with asphalt.

Bids will be received until Nov. 24 by the Bd. Co. Comrs. for constructing drains and remetaling a portion of Deerfield Road, Sycamore Township. C. C. Richardson, Co. Aud.

Allegheny, Pa.—It is reported that bids will be received until Nov. 9 by Edwd. J. McIlvain, Dir. Dept. Pub. Wks., for regrading and repaving Irwin Ave.; also grading, curbing and paving Anna St.

Sherman, Tex.—Chas. E. Haydon, City Engr., writes that the following are the bids opened Oct. 23 for brick paving (number of sq. yds. of brick paving 14,290): (*a*) R. K. Dabney, Grand Prairie, Tex.; (*b*) R. H. Fleming & Co., of Ludlow, Ky., and Newport, Ky.:

	a	*b*
4,145 lin. ft. rock curb	$0.60	$0.56
413 lin. ft. 3 x 12-in. wood end headers	.09	.07
Concrete, per cu. yd	4.70	4.40
Cushioning sand, per cu. yd	1.00	1.00
Brick in place, per sq. yd., including rolling grouting, etc.	1.15	1.13

**Kenosha, Wis.*—John O. Jones, of Racine, is stated to have received the contract for paving a portion of Market and Lake Sts., also 2 alleys between Main, Exchange, Park and Market Sts., for $8,628.

Brandon, Man.—The City Council is considering the paving of Rorser Ave. with asphalt or macadam. If it is decided to go on with the work next year, about 14,000 sq. yds. will be laid. W. H. Shillinglaw, City Engr.

POWER PLANTS. GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Guntersville, Ala.—The question of constructing water works and an electric light plant is reported under consideration.

Mojave City, Ariz.—Bids will be received until Nov. 28 by the Comr. Indian Affairs (F. E. Leupp, Comr.) Washington, D. C., for furnishing material and constructing a power house with steam pumps, etc., and a brick hospital building with plumbing and acetylene gas piping at the Ft. Mojave School. For further information apply to Duncan D. McArthur, Supt., Mojave City.

Springdale, Ark.—Spencer Owen is reported to have secured the franchise for constructing an electric light plant.

Argenta (Little Rock), Ark.—W. E. Pearsall, Chmn. Bd. Comrs., writes that the committee has now under consideration the employing of an engineer, to prepare plans and specifications for water works and an electric light plant, to cost between $65,000 and $85,000. As soon as plans are completed bids will be called for.

San Francisco, Cal.—Local press reports state that arrangements have been completed for the financing of the Stanislaus Electric Co., which was recently incorporated, to establish an electric power station on Stanislaus River and furnish electric light and power to Stockton, San Jose, San Francisco and intermediate points. Leopold Michaels, Pres., San Francisco Gas & Coke Co., is reported interested.

Calistoga, Cal.—The Calistoga Electric Light & Power Co. is reported incorporated, with a capital of $20,000, to construct and operate an electric light and power plant. Incorporators: G. S. Cutler and E. L. Armstrong, of Calistoga; R. Benjamin, of Napa., and others.

Randsburg, Cal.—The Kern Rand Co., recently incorporated in Arizona, and with offices at Los Angeles, Cal. is reported to be planning the erection of a power house on the south fork of Kern River, and the construction of an electrical transmission line to Randsburg.

Montrose, Colo.—W. C. Fink, of Montrose, writes that he has a franchise in this city for laying pipes for supplying natural gas. He expects to begin the sinking of gas wells at an early date and pipe natural gas to this city. He has now under control land two-thirds of a mile from city. He has not selected the machinery nor contracted for the pipe required. No engineer has been selected as yet; probable cost of plant, $50,000.

Washington, D. C.—Bids will be received until Nov. 14 at the Bureau Supplies and Accounts, Navy Dept., Washington, D. C., to furnish at the Navy Yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C., and Norfolk, Va.; a quantity of Naval supplies as follows: Schedule 204: Sand, tin, steam trap, etc. Schedule 205: Insulated iron wire, generating sets, etc. Schedule 206: Electric cable and sockets, cement, steel shapes and billets, iron, etc. Schedule 207: Electric cable and insulators, copper wire, cement, hydraulic jacks, etc. Schedule 208: Motors, pig iron, etc. Schedule 209: Drilling posts, galvanized sheet steel, tin, etc. Applications for proposals should designate the schedules desired by number. H. T. B. Harris, Paymaster-Gen., U. S. N.

Pensacola, Fla.—Bids will be received until Nov. 21 at the Bureau Supplies and Accounts, Washington, D. C., to furnish at the Navy Yard, Pensacola, a quantity of Naval supplies as follows: Schedule 211, twist drills, plain and corrugated sheet steel iron and steel pipe, pipe fillings, gate valves, dredging materials, etc. Schedule 212, electrical fixtures, bar and sheet steel, etc. Schedule 213, motors, pneumatic tools, etc. Applications for proposals should designate the Schedule desired by number. H. T. B. Harris, Paymaster Gen., U. S. N.

Jacksonville, Fla.—Bids will be received until Nov. 14 at the Treasury Dept., Washington, D. C. (H. A. Taylor, Acting Secy.) for manufacturing and placing in position in complete working order in the U. S. Custom House, Jacksonville, certain combination gas and electric light fixtures.

Atlanta, Ga.—The Southern Light & Power Co. (T. J. Kelly, Pres.) is reported to have decided to issue $500,000 bonds, to be used for the construction of an electric plant in or near Atlanta, for the purpose of furnishing power to Fulton and De Kalb Counties.

Rockford, Ill.—The American Gas Co. is reported to have decided to double the capacity of its plant.

Lockport, Ill.—Bids will be received until Dec. 27 (extension of date) by the Bd. Trus., Sanitary Dist., at Chicago (S. D. Griffin, Clk.) for constructing a canal lock, movable dams and a fender wall in connection with the water power development now being made near Lockport.

Freeport, Ill.—It is reported that bids will be received until Nov. 18 by Wm. Waterstradt, City Clk., for lighting the city for a term of 5 years.

Zionsville, Ind.—The Zionsville Lumber Co. is reported to have decided to construct an electric light plant.

Evansville, Ind.—The Evansville Gas & Electric Light Co. is reported to be asking for bids for additions to its plant; also for new machinery and electrical equipment.

Geneva, Ind.—W. R. Thurston is reported to have secured a franchise for the construction of an electric light plant.

Paola, Kan.—The citizens are reported to have voted to issue $25,000 bonds to construct an electric light plant; also $50,000 to purchase the water works.

Morehead, Ky.—The City Council is reported to have granted J. E. Davidson a franchise to light the city.

Worcester, Mass.—The Worcester Electric Light Co. is reported to have petitioned the State Gas and Electric Light Comn. for permission to issue $200,000 capital, to be used for the enlargement and development of its plant.

Warren, Mass.—The Worcester County Gas Co. is reported to have secured a franchise to lay pipe and furnish Warren with gas.

**Muskegon, Mich.*—Buck & Mullen are reported to have received the contract for constructing the substation of the Grand Rapids-Muskegon Water Power Co., for about $65,000.

**Grand Rapids, Mich.*—Sam'l A. Freshney, Sec'y. and Gen. Mgr. Bd. Pub. Wks., writes that the Ft. Wayne Electric Works, of Ft. Wayne, Ind., has secured the contract for a direct-connected unit, consisting of engine, alternator and appurtenances (bids opened Oct. 20), for $3,554.

Iron Mountain, Mich.—The City Council has granted A. W. Glass, and others, a franchise for a gas plant.

Owatonna, Minn.—C. L. Powell, of Belvidere, Ill., Mgr. Owatonna Gas, Electric & Htg. Co., is reported interested in the construction of a gas plant here.

Foley, Minn.—The Village Clerk writes that nothing will be done this year toward the construction of water works and an electric light plant, as it has been decided not to issue the bonds.

Winona, Minn.—The Winona Gas Light & Coke Co. is reported to have decided to make extensions and improvements to its plant.

Warsaw, Mo.—Bids will be received at the office of S. O. Davis, Mayor, until Nov. 10, for furnishing material and equipment for an electric light plant, as advertised

Fremont, Neb.—It is stated that it is proposed to install 3 new boilers and make other improvements at the municipal electric light plant.

Newark, N. J.—Runyon & Carey, the engineers employed by the city to consider the question of establishing an experimental station with a capacity of 500 lamps, have submitted their report to the Bd. of Wks., and the Special Committee of the Bd. of Wks. has recommended the immediate erection of a plant of the capacity of 500 lights at the Belleville pumping station; the probable cost of its construction is $125,000, with $65 per light a yr. for the operating cost, covering everything.

New York, N. Y.—Bids will be received until Nov. 13 by C. B. J. Snyder, Supt. School Bldgs., New York City, for installing electric equipment in School 42, Boro. Bronx.

Shawnee, Okla. Ter.—Milo B. Campbell, Chas. A. Wilson and Harry P. Harvey, representing capitalists in Battle Creek, Mich., are reported to have applied for a franchise to operate a gas plant in this city.

Philadelphia, Pa.—Bids will be received until Nov. 18 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for furnishing and installing underground, lead-incased, hard-covered, arc and incandescent lighting cables as per specification No. 1456 at the U. S. Navy Yard, League Island, Pa.; estimated cost, $12,500.

Huntingdon, Pa.—The Juniata Water & Water Power Co., Perry Bldg., Philadelphia, is reported to have increased its capital from $5,000 to $75,000. It is stated to be the purpose of the company to construct a plant for the generation of electricity on Juniata River, near Huntingdon.

Bamberg, S. C.—G. Moye Dickinson, Mayor, writes that it was voted Oct. 24 to issue $15,000 bonds for the construction of an electric light plant. The Board of Public Works will have charge of the construction.

Lawrenceburg, Tenn.—The citizens are reported to have voted to issue $25,000 bonds for the construction of water works and an electric light plant.

Shenandoah, Va.—It is stated that Mayor S. D. Louderback will receive bids until Nov. 14 for an electric light and motor power franchise.

Everett, Wash.—The City Clk. is reported to have been authorized to procure bids for lighting the city for a term of 5, and 10 years.

Ballard, Wash.—The entire plant and franchise of the Ballard Electric Co. is reported to have been sold to the Seattle Electric Co., and it is stated that many improvements and additions will be made to the plant.

Walla Walla, Wash.—The Northwestern Gas & Electric Co. (Isaac W. Anderson, Mgr., Walla Walla) is reported to have decided to install a new power plant on the upper Walla Walla River.

Charleston, W. Va.—The City Council has passed the ordinance granting the Kanawha Gas Co. a franchise to establish and operate a gas plant.

Milwaukee, Wis.—The capital of the Wilwaukee Coke & Gas Co. is reported to have been increased from $1,000,000 to $2,000,000 and extensive improvements will be made.

Port Washington, Wis.—Wm. A. Tholen, City Clk., writes that an ordinance was passed and approved on Oct. 23, providing for the construction of water works and an electric light plant.

Beloit, Wis.—C. S. Jackman, of Janesville, and W. G. Maxcy, of Oshkosh, are reported to have purchased the Beloit Gas Light & Coke Co. It is proposed in the spring to erect a new gas holder and extend the mains.

Ft. D. A. Russell, Wyo.—Bids will be received by Capt. W. S. Scott, Q. M., U. S. A., Cheyenne, until Dec. 2, for furnishing and installing electric fixtures in certain buildings and for extending the lighting system so as to make proper connection therewith, at Ft. D. A. Russell, as advertised in The Engineering Record.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Vallejo, Cal.—It is stated that at the annual meeting on Oct. 16 of the Vallejo, Benicia & Napa Valley R. R. (M. K. Miller, Ch. Engr.) it was decided to extend the line to St. Helena and Calistoga as soon as the work can be done, and within the next 3 years the company expects to expend several million dollars in extensions and improvements.

San Francisco, Cal.—It is reported that the San Bruno line of the United Railroads will be extended to Railroad Ave. to connect with the Kentucky St. line. The 18th St. or Park branch of the San Mateo line may be extended to 8th and Harrison Sts. Other changes are said to be contemplated on the south side electric lines with a view to giving the residents of the southwest Mission, Ocean View and Potriro sections through service wherever pos-

Oakland, Cal.—At a recent meeting of the City Council the San Francisco, Oakland & San Jose Ry. Co. is stated to have presented an application for the crosstown franchise along 22d St. The matter was referred to the St. Ry. Com. The proposed line will follow this route: From the tracks of the Key Route on Yerba Buena Ave., along Louise, Poplar and 22d St. and across certain private rights of way to Broadway. A terminal station will be built on the block at 22d St., Bway. and Franklin Sts.

Fairfax, Cal.—It is stated that a surveying party is running a line for the proposed extension of the third-rail system of the North Shore R. R. from Fairfax to Point Reyes. The North Shore R. R. Co. (B. H. Fisher, Ch. Engr., Sausalito) is reported to be making preparations to extend its electric service to the district lying north to White's Hill tunnel.

Washington, D. C.—The Washington, Frederick & Gettysburg Ry. Co. is reported organized with D. Columbus Kemp, Pres.; Chas. C. Waters, Secy.; F. B. Smith, Treas.; Oscar B. Coblentz and C. D. Eldridge, Civil Engrs., are reported to have been authorized to prepare an estimate of the cost of construction of the road from Frederick to Thurmont.

East St. Louis, Ill.—It is stated that the Illinois & Indiana Electric R. R. Co. will apply for a franchise at the next meeting of the East St. Louis City Council, to operate a street railway over certain streets in the southern part of the city, starting at Fourth St. and Bway. This line is to connect with an electric road to be operated south through Falling Springs and other places along the bluffs.

Streator, Ill.—The Illinois Light & Traction Co., of Streator, is reported incorporated with a capital of $400,000. I. H. Sherwood, W. V. Coons and Fred Edwards are reported interested. The object of the company is to furnish light, heat and power, and to construct gas and electric light plants in adjoining towns.

**Bluffton, Ind.*—The contract for the construction of the Marion, Bluffton & Eastern Electric Ry. is reported to have been awarded to the Moore-Mansfield Co., of Indianapolis. The firm is to do the grading, build the fences, lay ties and rails for a distance of 31 miles.

Chickasha, Ind. Ter.—The Washita Valley Interurban Ry. Co. is reported to be making arrangements for the right of way from Chickasha to Paul's Valley.

**Mason City, Ia.*—The Mason City & Clear Lake Traction Co. has let contracts for machinery for a new power station. The Westinghouse Co. will furnish the electrical equipment.

Huntington, L. I., N. Y.—Surveyors are reported to have been at work surveying for an electric railway from this village to Elmwood and Greenlawn. Fahie Berkeley, of the Brooklyn Bond & Mortgage Title Co. is reported interested.

Rochester, N. Y.—The Buffalo & Rochester Traction Co., which proposes to build an electric railway to Rochester from Depew, is stated to have applied for a franchise. The road will touch Batavia, Le Roy, Caledonia.

Steubenville, O.—The Steubenville & Wellsburg Ry. Co. is stated to have been granted a franchise over certain streets in Steubenville. The company will operate a line from Steubenville to Wellsburg and Follansbee, W. Va.

Athens, O.—A. P. Gatch, W. H. Newell and John Finsterwald are stated to have been granted a franchise in Athens for terminals for the proposed line to Nelsonville.

Oklahoma City, Okla. Ter.—The City Council is stated to have granted a franchise to the Oklahoma City, Sulphur Springs & Lexington Electric Ry. to enter the city from the south via Broadway and Grand Ave.

Portland, Ore.—W. P. Hawley, of Oregon City, is reported to have announced that Eastern capitalists are preparing to build an electric railway from Portland to Roseburg. W. P. Hawley is stated to be the owner of 30 miles of water rights on the Santiam River, and it is understood that power generated on this river will operate a large section of the proposed road.

The St. Helens Public Service Co. (L. O'Connor, Secy.) is projecting a loop electric line from Portland, in a northerly direction around Mt. St. Helens, tapping the copper camps in that region and passing through the timber belt in the State of Washington. It has already surveyed 100 miles of the 200 miles in this loop, and secured franchises in all the cities which the loop will in part serve. Geo. W. Lilly, Ch. Engr., is in the field with a corps of engineers, and expects to have all surveying completed by spring. Dr. Henry Waldo Coe, of Portland, Ore., is Pres.

Philadelphia, Pa.—The construction of the Roxborough R. R., a branch of the Pennsylvania-Chestnut Hill line, planned several years ago, is reported under consideration. Most of the right of way from Chelton Ave. in German-

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**Items marked thus give the names of parties awarded contracts.*

town, through Roxborough, Barren Hill, Marble Hall to Allentown, has been obtained. It is proposed to make it an electric line, operated by the third-rail system.

Pittsburg, Pa.—Frederick W. Mueller and others are stated to have secured a charter for a street railway to be known as the Library & West Liberty St. Ry., which will operate in the southern part of Allegheny County.

Port Washington, Wis.—The Milwaukee Northern Ry. Co., of Port Washington, is reported to have filed articles of incorporation in the office of the Secretary of State. The company intends to build an interurban electric railway from Sheboygan to Milwaukee, touching Fond du Lac, Port Washington and other places.. Capital, $100,000. Incorporators: John E. Uselding, of Port Washington; John M. Seamann, of Sheboygan, and Peter P. Brueckbauer, of Elkhart.

Toronto, Ont.—It is stated that the Electrical Co. will absorb all the other electric companies in Ontario. It is the intention of the company to cover all Ontario with electric railway lines. The Electrical Development Co. (Frederick Nicholls, Pres.) is reported to have been negotiating for the right of way for the St. Catharines, Pelham & Welland Electric Ry., which is to traverse the whole of the Niagara fruit district. When the transmission lines are completed to London, it is probable another radial road will be constructed, or arrangements made to take over the right of way and franchises of the South-Western Traction Ry.

RAILROADS.

Notes Arranged Alphabetically by States.

Red Bluff, Cal.—The Red Bluff & Fall River R. R. Co. is reported organized, with G. K. King, Pres., and D. E. Miles, Sec'y. The company expects to begin active work at once. It is proposed to build a road from this city to Fall River mills by way of Shingletown, and will tap the timber belt lying between these two terminals.

Durango, Colo.—The Rio Grande R. R. Co. (E. M. Biggs, Gen. Mgr., Edith, Colo.) is reported to have decided to construct a standard gauge line from Durango through Pagosa Springs, to connect with the Creede branch.

Mattoon, Ill.—The Illinois Central Ry. Co. (A. S. Baldwin, Ch. Engr. Chicago, Ill.), is reported to have decided to expend about $500,000 during the next 12 months on improvements in the vicinity of Mattoon. The work includes the construction of a subway, 2 miles in length. It is also proposed to erect a union depot here for the Illinois Central and Big Four R. R.

**Burnett, Ind.*—O. D. Guifoil, of Terre Haute, is reported to have secured the contract for double-tracking the Cleveland, Cincinnati, Chicago & St. Louis R. R. from Burnett to Carbon, a distance of about 10 miles.

Hickman, Ky.—The Iron Mountain R. R. Co. (E. E. Mitchell, Engr. of Construction, St. Louis, Mo.) is reported to have decided to extend its line from Charleston, Mo., to Hickman, Ky., to connect with the Louisville, Chattanooga & St. Louis Ry.

**Hershey, Neb.*—W. C. Bradbury, of Denver, Colo., is reported to have secured the contract for constructing a branch of the Union Pacific R. R. bet. Northport and Hershey, about 125 miles.

Newark, N. J.—Morris R. Sherrerd, Ch. Engr. and City Surveyor, is reported to have been directed by the Bd. of Works to arrange for a conference of officials of the Lehigh Valley & Pennsylvania Railroads and the Public Service Corporation to devise a plan for the abolishment of the Frelinghuysen Ave. grade crossing.

Charlotte, N. C.—The North Carolina Connecting Ry. Co. is reported incorporated, with a capital of $450,000, to build a road from Spring Hope, N. C., to Roxboro, N. C., traversing 7 counties. Permission is also granted to build branches.

Lorain, O.—The Lake Erie & Pittsburg R. R. Co., which proposes building a railroad between Lorain, Youngstown and Pittsburg is stated to have decided to begin the construction of the terminal in Lorain in the spring. Attorney Thompson, of Lorain, is reported interested.

Manila, P. I.—The prospectus is on file at the office of The Engineering Record, 114 Liberty St., New York, N. Y., and bids will be received by the Bureau of Insular Affairs, War Dept., Washington, D. C., until 9 a. m., Dec. 13, and by the Philippine Comn., at Manila, P. I., until 10 p. m., Dec. 15, for concessionary contracts or grants with and by the Philippine government, in aid of the construction, equipment, maintenance and operation of lines of railway in the Philippine Island, in all about 1,233 miles. Bids will be received only from individual citizens or copartnership of the United States or the Philippine Islands or from railroad corporations duly organized and existing under the laws of a State in the U. S. or the United States or Philippine Islands. Wm. H. Taft, Secy. of War, Washington, D. C. Capt. Frank McIntyre, 19th U. S. Infantry, Asst. to Chief of Bureau, Bureau of Insular Affairs, Washington, D. C.

Wilkinsburg, Pa.—It is stated that Frease & Sperling, Boro. Engrs., estimate the cost of the borough's share of abolishing the grade crossings on the Pennsylvania R. R. at $95,979.

Cheraw, S. C.—A. G. Page, of Cheraw, Supt. Chesterfield & Lancaster R. R. Co., writes that it is proposed to extend the line westerly from Ruby, S. C., to Lancaster, a distance of about 20 miles; probable cost of work, $200,000. Engineer, C. H. Acott, of Ruby.

Sioux Falls, S. D.—The South Dakota Central R. R. Co. (P. F. Sherman, Pres.) is reported to have decided to continue its line north from Wentworth to Watertown and west from Chester to Canova, with a branch into Madison.

Veblen, S. D.—C. L. Haydock, of Huron, Ch. Engr. Veblen & Northwestern R. R. Co., writes that it is proposed to construct a railroad in northeastern South Dakota, a distance of about 40 miles. M. J. Hawley, Pres., Veblen.

Salt Lake City, Utah.—Archibald C. Milner, of Salt Lake City, Vice-Pres. Coal Belt Ry. Co., writes that it is proposed to construct a line through Utah, Wasatch and Carbon Counties to the coal mines, about 89 miles in length; probable cost of construction $2,000,000.

Seattle, Wash.—The Pacific Coast R. R. Co., recently incorporated, proposes constructing a line from some point on Puget Sound in Kings County southeasterly to a point on Columbia River in Walla Walla County; estimated length, 250 miles. H. R. Williams, Pres.

Ottawa, Ont.—The Railway Comn. is reported to have authorized the Grand Trunk Ry. Co. (J. Hobson, Ch. Engr., Montreal, Que.) to construct a branch line through the Township of Chinguacousy, County of Peel.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Montgomery, Ala.—Bids will be received until Nov. 13 by R. S. Williams, City Treas., for furnishing steam piping at city water work station.

Redding, Cal.—It is reported that the citizens have voted in favor of issuing $145,000 bonds, the proceeds to be used to extend the sewer system, improve the streets and erect a city hall.

Greeley, Colo.—The City Council, it is stated, has accepted the plans of Albert Bryan, of Ft. Collins, for the city hall which it is proposed erecting at a cost of $20,000. It is to be 2 stories, of brick and stone, 50x70 ft.

**Washington, D. C.*—Contracts have been awarded as follows for work at the U. S. Soldiers' Home, Washington, bids opened Sept. 30, by Capt. John Stephen Sewell, Corps Engrs., U. S. A.: To Matthew Myers, Washington, excavation, etc., $9,180; S. Dana Lincoln, Washington, cement, hydrated lime, $6,591; Gilmore D. Holmes, Washington, stone, gravel, sand, $5,891; Laurel Clay Products Co., Laurel, Md., brick, $11,687; Brennan Constr. Co., Washington, laying brick and slate, $13,172; The R. J. Beall Constr. Co., Washington, concrete work, $1,925, and to C. C. Magruder, Hyattsville, Md., cement shed, $800.

Jacksonville, Fla.—All bids opened on Oct. 23 for erecting the jail have been rejected. It has not yet been decided whether new bids will be received; the work may be done by the day. Philip Priolean, City Engr.

Homer, Ga.—Bids will be received until Nov. 15 by T. F. Hill, Co. Ordinary, for erecting a fireproof jail. J. W. Golucke, Archt., 510 Temple Court, Atlanta.

Evanston, Ill.—The City Council, it is stated, has appropriated $25,000 for the public library toward which Andrew Carnegie offered to give $50,000. It is stated that plans will be prepared for the structure at once.

Peru, Ind.—It is reported that the Co. Comrs. have accepted the plans of Crapsey & Lamm, of Cincinnati, O., for the court house which it is proposed erecting at a cost of about $280,000.

Louisville, Ky.—The Kentucky Anti-Tuberculosis Assoc., it is stated, intends erecting a tuberculosis hospital, to cost about $25,000.

Baltimore, Md.—Bids will be received until Nov. 8 by the Bd. Awards (E. Clay Timanus, Pres.) for furnishing materials and completing the alterations to old City Hall.

It is stated that competitive plans are soon to be asked for the municipal hospital to be erected on Hardesty tract, east of Bayview Asylum.

**Springfield, Mass.*—The Hampden County Comrs. are reported to have awarded to Fosburgh & Co., of Boston, the contract for erecting the new Hall of Records (bids opened Oct. 24) for $118,000. Architects, Shepley, Rutan & Coolidge, Boston.

Detroit, Mich.—Schilling & Van Leyen, of Detroit, it is stated, have completed plans for a $10,000 public convenience station which is to be erected in Cadillac Sq. by Park Comr. Bolger.

Bids will be received about Nov. 20 for the erection of a casino at Belle Isle Park, to cost about $100,000. Architect, Edw. A. Schilling, 40 Fort St., Detroit.

St. Paul, Minn.—The Trus. of the Luther Hospital, at 10th and John Sts., it is stated, intend erecting a new building, to cost about $100,000. A committee has been appointed, of which A. L. Alness is a member, to secure plans, etc., for said building.

St. Louis, Mo.—T. W. Hackett, 3013 Lucas Ave., it is stated, submitted the lowest bid for erecting the fire engine house for Company No. 45, at $15,898.

**Overbrook, N. J.*—It is stated that Richard E. Heningham, of Brooklyn, N. Y., submitted the lowest bid on the entire work for erecting buildings at County Hospital for Insane at Overbrook, bids for which were opened in Newark on Oct. 30 by the Pub. Bldg. Com. of the Bd. Chosen Freeholders (Hugh Gallagher, Chmn.) at $1,073,980. Bids were also received and opened on various parts of the work.

New York, N. Y.—Bids will be received until Nov. 17 by Maurice Featherson, Comr. Docks, for furnishing material and erecting at the foot of Whitehall St., East River, a new ferry house in connection with the new Whitehall Ferry Terminal.

Brooklyn, N. Y.—Bids will be received until Nov. 14 by the Bd. Health (Thos. Darlington, M. D., Pres.), N. Y. City, to furnish and install 2 new boilers in the boiler house at the Kingston Ave. Hospital; also furnishing material and constructing an underground pipe gallery at said hospital, Boro. Brooklyn.

It is stated that plans have been adopted and the Dept. of Charities is about to erect a city hospital at Coney Island Creek and the parkway, to be known as Coney Island Hospital.

**Kingston, N. Y.*—The State Armory Board on Oct. 24 awarded the contract for reconstructing drill hall and other improvements to the Kingston Armory to The Hudson Valley Constr. Co., of Troy, for about $30,000.

Ft. Michie, N. Y.—Bids will be received until Nov. 23 by the Constr. Acting Q. M., U. S. A., New London, Conn., for constructing heating, plumbing and electric wiring hospital at Ft. Michie.

Rockaway Park, L. I., N. Y.—It is stated that about $20,000 has been subscribed for the new building for the sanitarium for Hebrew children at Rockaway Park.

Elmira, N. Y.—Bids will be received by Dr. Chas. F. Howard, Pres. Bd. Mgrs., New York State Reformatory, Elmira, until Nov. 13 for heating and steam connections to machinery, plumbing, electric light wiring and fixtures for laundry, shops and bathhouse at the N. Y. State Reformatory, as advertised in The Engineering Record.

Oswego, N. Y.—A survey is now being made for the erection of a new armory. Plans will soon be prepared.

Condon, Ore.—The Sisters of Charity of the Benedictine Order, it is stated, intend erecting a brick hospital here, to cost about $12,000.

Enid, Okla. Ter.—J. F. Danelt, County Clk., writes that bids are wanted Nov. 28 for the erection of a courthouse, to cost about $100,000.

**Philadelphia, Pa.*—The Trus. of the Free Library, it is stated, on Oct. 31 awarded to Jacob Myers & Sons, Witherspoon Bldg., the contract to erect the 1-story brick branch library at Tacony, at Torresdale Ave. and Knorr St., at a cost of about $35,000.

Bids will be received until Dec. 2 by Lieut. Col. R. L. Hoxie, Corps Engrs., U. S. A., Philadelphia, for constructing a dwelling, oil house, barn, etc., at the Reedy Island Range Rear Light Station, Del.

Harrisburg, Pa.—It is stated that bids were opened Oct. 27 for erecting a home for nurses, and several buildings at the State Hospital for the Insane at Harrisburg, the 5 lowest bids submitted being as follows: Coden & Miller, Harrisburg, $128,000; the Menough Co., York, $131,390; Ballinger & Co., Philadelphia, $143,224; Chas. McCaul Co., Philadelphia, $145,354, and Henderson & Co., Philadelphia, $154,404.

Memphis, Tenn.—It is reported that Jones & Furbringer are preparing plans for a 4-story brick hospital which is to be erected at Union and Middle Sts. for the Lucy Brinkley Hospital at a cost of $20,000.

Wausau, Wis.—The following are reported to be the bids received for erecting the public library: Wausau Constr. Co., $23,486; John Miller, Wausau, $24,210; Hoeppner, Bartlett & Co., Eau Claire, $25,150; J. L. Simmons, Chicago, Ill., $27,150; Hansen Bros., Chicago, Ill., $31,974; William Mavur Co., Chicago, Ill., $32,868, and Bully & Andrews, Chicago, Ill., $33,226.

Bids received for the (*a*) heating and (*b*) plumbing of said building are reported to have been received as follows: Hett Bros., Wausau, *a* $835, *b* $1,355; A. B. Wheeler & Son, Wausau, a $1,460, b $850; Wausau Constr. Co., a and b $2,300; Danielson Plumb. Co., Wausau, *a* and *b* $2,475.

Ft. D. A. Russell, Wyo.—Bids will be received until Dec. 2 by Capt. W. S. Scott, Q. M., U. S. A., Cheyenne, for furnishing material and constructing at Ft. D. A. Russell, a 245x108-ft. brick cavalry drill hall with steel truss roof, as advertised in The Engineering Record.

Woodstock, N. B.—See "Schools."

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—Morgan & Walls, Farmers & Merchants' Bank Bldg., it is reported, have completed plans for a $100,000 building to be erected by L. W. Hellman.

San Francisco, Cal.—The Grand Lodge of Masons of California, it is reported, have appointed a committee of which Reuben H. Lloyd is Chmn., to take charge of the matter of erecting a temple.

San Diego, Cal.—It is reported that articles of incorporation have been filed by the Elks Hall Assoc. for the purpose of erecting a hall to cost $23,000. W. Mifflin Smith is one of the directors.

Denver, Colo.—Chauncey Blair, of Chicago, Ill., it is reported, intends erecting a 5 or 6-story business building on 15th St. and Cleveland Pl., Denver, at a cost of about $100,000.

Denver, Colo.—Robt. S. Peterson and B. C. Lyde, it is stated, intend erecting a business block and apartment house at 1844 Champa St., to cost $20,000. Kidder & Weiger, Archts.

Wagner & Manning, it is stated, are preparing plans for a 2-story business block to be erected on California and 22d Sts. for Ernest E. Cook, the cost to be about $15,000.

The Matthewson Automobile Co., it is reported, has engaged W. E. Fisher to prepare plans for a garage which they intend erecting on Bway. at a cost of $20,000.

Washington, D. C.—The following are the bids opened on Oct. 27 for erecting a building for the Metropolitan Citizens Bank: A. B. Stannard, New York, N. Y., $237,700; Fissel & Wagner, New York, N. Y., $255,603; S. H. Edmonston, Washington, $297,203; W. E. Spier, Washington, $247,900; John McGregor, Washington, $246,229; J. L. Parsons, Washington, $267,000; C. A. Langley, Washington, $249,381; Norcross Bros., Worcester, Mass., $239,644; S. J. Prescott & Co., Washington, $253,790; Cramp & Co., Philadelphia, Pa., $248,054; Thompson-Starrett Co., New York, N. Y., $255,500; G. A. Fuller Co., New York, N. Y., $247,735 and Wells Bros. Co., New York, N. Y., $269,000.

Jacksonville, Fla.—Hon. Telfair Stockton, it is stated, intends erecting a 10-story reinforced concrete office building with steel braces, on Forsyth St., the cost complete to be about $100,000.

Atlanta, Ga.—Joel Hunt, it is stated, is having plans prepared for a theatre to be erected on Edgewood Ave., and to be leased to Jake Wells and Henry L. De Give.

Mattoon, Ill.—See "Railroads."

Chicago, Ill.—The erection of a $2,000,000 building as a home for the physicians of Chicago, it is reported, is under consideration. Dr. Danl. R. Bower may be able to give further information.

Andrew Sandegren, 119 Monroe St., has prepared plans for an addition to the Oakwood Hotel, at Drexel and Oakland Boule., for S. P. Parmly & Co. The annex will be 5 stories high, 30x70 ft., and cost $50,000.

Marshall & Fox are the architects for a $25,000 addition to the Chicago Automobile Clubhouse, at Michigan Boule. and Hubbard Court.

Henry L. Ottenheimer, 109 Randolph St., is preparing plans for a 3-story store and apartment building to be built at Ashland Boule. and 12th St. for Wesley Dempster. The building will be 190x100 ft. and cost $100,000.

Des Moines, Ia.—Plans have been prepared, according to reports, for a $25,000 building which is to be erected in this city by F. M. Hubbell & Sons for Senfield & Co., of Davenport, wholesale milliners.

Indianapolis, Ind.—The plans of H. C. Brubaker, Jr., Aetna Bldg., and W. K. Eldridge, assoc. archts., it is stated, have been accepted for the Bd. of Trade Bldg., which is to be erected at Meridian and Ohio Sts. The building is to be 8 stories high and will cost about $300,000.

A. G. Zimmerman, of Chicago, Ill., is preparing plans for a warehouse to be built at Indianapolis for the National Biscuit Co. It will be a 3-story structure and cost $125,000.

**Items marked thus give the names of parties awarded contracts.*

Evansville, Ind.—It is stated that plans have been perfected for the erection of a $200,000 10-story building at 4th and Sycamore Sts. next spring. W. H. McCurdy is interested in the project.

Muscatine, Ia.—It is stated that the erection of a commercial hotel here, to cost about $50,000, is under consideration.

Coffeyville, Kan.—The Tackett Auditorium Co. is said to be considering the erection of an opera house here at a cost of $40,000.

Hopkinsville, Ky.—Jas. L. Long is reported to be preparing plans for a business building to be erected here, at a cost of 30,000.

Louisville, Ky.—The Directors of the Lincoln Savings Bank, it is stated, have accepted plans for a 12-story office building, which they intend erecting on 4th Ave. and Market St., at a cost of about $125,000.

The Bd. of Directors of the Seelbach Realty Co. on Oct. 28, it is stated, engaged F. M. Andrews, of Dayton, O., and W. J. Dodd and Kenneth McDonald, of Louisville, as the architects for the 10-story annex to The Seelbach Hotel. It is reported that contracts for construction will be let about January.

The Bd. of Directors of the Seelbach Hotel, it is reported, is considering the plans for a 10-story annex which it is proposed erecting at a cost of about $300,000. The Seelbach Realty Co., owners.

**New Orleans, La.*—The Cook & Laurie Contr. Co., of Montgomery, Ala., it is reported, has secured the contract to erect an office building for the Equitable Real Estate Co., at a cost of $40,000.

Baltimore, Md.—Furness & Co. and McKim, Mead & White, 160 5th Ave., N. Y. City, Assoc. Archts., it is stated, have filed plans for the 2-story stone and steel Girard Trust Bldg., which is to be erected on Broad and Chestnut Sts. at an estimated cost of $2,000,000.

Worcester, Mass.—The Worcester Ry. Co. will erect a brick and steel open air theatre at Lake Quinsigamond, at a cost of $50,000. Architect, Edwin T. Chapin, 340 Main St.

Boston, Mass.—Winslow & Bigelow, Phillips Bldg., it is stated, have prepared plans for a 10-story office building which is to be erected at Water and Congress Sts. for the Shawmut Natl' Bank.

Duluth. Minn.—Phil. Bevis, Gen. Secy. Y. M. C. A., writes that it is proposed to erect a building at a cost of $125,000 and are now raising funds. No architect chosen as yet.

St. Paul, Minn.—The German Central Bund, it is stated, has appointed a committee, of which Wm. Foelsen and Wm. Hamm are members, for the purpose of securing plans for a hall which it is proposed erecting for the German Societies, the cost to be about $75,000.

It is stated that the plans for the theatre which is to be erected by the Orpheum Circuit Co. at St. Peter and 5th Sts. have been approved by the Bldg. Comr. Kees & Colburn, Archts., Minneapolis.

St. Louis, Mo.—The N. O. Nelson Mfg. Co., it is stated, has applied for a permit to erect an 8-story warehouse, 134 x 112 ft., at 914 Chestnut St., the cost to be about $150,000.

It is stated that bids will be received until Nov. 11 by Wm. A. Cann, Archt., Missouri Trust Bldg., for erecting a 5-story mercantile and office building for the Unity Bldg. Co.; cost, $150,000.

Butte, Mont.—It is stated that the members of the Silver Bow Club have secured a site at Granite and Alaska Sts. and intend erecting next spring a club house to cost about $125,000.

Harlowton, Mont.—The Harlowton Bldg. Assoc., it is reported, has been incorporated with a capital of $22,000 for the purpose of erecting a business building at Harlowton. Incorporators: J. J. Fisher, T. F. Hanzlik, and others.

**Omaha, Neb.*—The Capital City Brick & Tile Co., it is stated, has secured the contract to erect a building for Wright & Wilhelmy Jobbing Hardware Co., at about $77,620, not including plumbing, heating, wiring, etc.

Newark, N. J.—Plans have been filed for a 5-story brick store and apartment building to be erected at Springfield and 18th Sts., at a cost of $50,000, by Jos. Okin.

Marcus G. Goodman, it is reported, has had plans prepared by Hyman Rosensohn for a 4-story and basement brick store and apartment building, to be erected on Prince St., at a cost of $60,000.

New York, N. Y.—See "Churches and Dwellings."

**Troy, N. Y.*—The Hudson Valley Constr. Co., Times Bldg., has secured the entire construction contract for a new brick engine house for the Burden Iron Co., of Troy, and the contract for a brick extension to the present boiler house.

Buffalo, N. Y.—It is reported that Geo. J. Metzger, 19 W. Huron St., has prepared plans for the remodeling of the Old Church of Our Father into a temple for the Buffalo Consistory of Scottish Rite Masons, the estimated cost is $37,000.

Elmira, N. Y.—The Women's Federation (Mrs. J. Sloat Fassett, Pres.), it is stated, is contemplating the erection of a united charities building, the cost to be about $40,000. It is reported that competitive plans are to be asked at once.

Albany, N. Y.—The John G. Myers Co., it is stated, has purchased a site on James St., on which they will erect a steel structure, 6 stories high in front and 8 stories in the rear. Trowbridge & Livingston, of New York, it is reported, are preparing the plans.

Carson, Nev.—It is reported that revised plans for the reconstruction of the pleasure and health resort at Shaw's Springs have been accepted and provide for a $40,000 hotel and an electric plant for pumping hot water.

**Winston-Salem, N. C.*—It is stated that E. C. Bowman & Co., of Birmingham, Ala., have received the contract to erect a $100,000 hotel on the site of Hotel Jones, on Main St.

Lima, O.—It is reported that W. L. Russell, of Cincinnati, O., is interested in a company which it is proposed to organize, with a capital of $300,000, for the purpose of erecting a theatre here.

Oklahoma City, Okla. Ter.—It is stated that a building permit has been granted to Geo. Hales to erect a 3-story brick business building on W. Main St., estimated to cost $20,000, and also to Bass & Harbour to erect a 5-story business building on W. Main St., estimated to cost $52,000.

Pittsburg, Pa.—F. N. Arble, it is stated, is preparing plans for a 5-story brick hotel to be erected on Lincoln Ave. by David Thompson, at a cost of $35,000.

Pulaski, Pa.—H. M. Wursing, of New Castle, it is reported, is the archt. for a hotel which is to be erected here by a syndicate at a cost of about $100,000. Henry Alvin Hall, of Pittsburg, may be able to give further information.

Philadelphia, Pa.—The House Com. of the Union League, it is stated, has accepted the plans of Jos. M. Huston, Witherspoon Bldg., for the improvements which it is proposed making at the Club. It is stated that the plans include the erection of a 6-story addition, the total cost of the improvements to be about $500,000.

At the session of the Eastern Synod of the Reformed Church on Oct. 28, at Williamsport, it is stated, it was decided to erect an office building in Philadelphia, to cost about $75,000.

It is reported that Horace Trumbauer, Archt., Land Title Bldg., has requested certain contractors to submit bids by Nov. 13 for erecting a $300,000 club house for the Racquet Club at 16th and Walnut Sts.

A building permit has been granted to Philip Haibach to erect a 5-story and basement addition, 51x59 ft., for the A. Schoenhut Co.; cost, $23,000. Ballinger & Perrot, Archts., 102 S. 12th St.

**Braddock, Pa.*—Otto Sinnhuber, of Rankin, it is stated, has secured the contract to erect a brick store and apartment building on Braddock Ave., Braddock, for Jas. Conley, at a cost of $20,000.

Nashville, Tenn.—It is reported that a permit has been granted to Hunter McDonald, W. P. Huggins and W. S. Bruce, to erect a $1,000,000 storehouse and business building.

Memphis, Tenn.—The plans of John Gaisford, it is stated, have been accepted by Macon & Andrews for a 4-story building which they propose erecting, to be used as a business college, the cost to be about $60,000.

L. M. Weathers & Co., Cotton Exchange Bldg., it is stated, are preparing plans for a 3-story, 40x100 ft. Masonic Temple, to be erected on DeSoto St., at a cost of $28,000.

Ft. Worth, Tex.—The Continental National Bank will expend about $40,000 in remodeling its building.

The Farmers & Mechanics' Bank will enlarge the Hoxie Building, at a cost of about $20,000.

San Angelo, Tex.—The members of the San Angelo Business Club, it is reported, are considering the erection of a $50,000 sanatorium.

Richmond, Va.—A site has been secured at Grace and 7th Sts., on which, it is stated, it is proposed erecting a Y. M. C. A. bldg., to cost about $130,000.

Tacoma, Wash.—It is stated that improvements are to be made to the Tacoma Hotel. W. S. Norman, of Spokane, is one of the owners, and Cutter & Malgrem, of Spokane, are the archts.

Spokane, Wash.—Mrs. August Kaiser, it is reported, intends erecting a hotel at a cost of $20,000.

Geo. Turner, it is reported, has secured a permit to erect a 4-story brick block to cost $150,000.

Seattle, Wash.—Josenhans & Allan, 74 Hinckley Blk., it is stated, have prepared plans for a hotel to be erected at 7th Ave. and Madison St. It is to be 4 stories high, of brick and stone and cost about $28,000.

Superior, Wis.—The erection of a Y. M. C. A. building, to cost about $30,000, is reported under consideration.

Milwaukee, Wis.—Hugo Koeffler, it is reported, is having plans prepared by Fernekes & Cramer, Pabst Bldg., for a 3-story brick and stone building, to be erected on 5th St. and Grand Ave. at a cost of about $40,000.

NEW YORK, N. Y.

147 W. 26th St., 6-story br. and stone loft bldg.; c, $60,000; o, Alex. L. Felt; a, Frederick C. Zobel.

306 E. 27th St., 2 6-story br. and stone stores and tenemts.; total c, $80,000; o, Jacob Wimpie; a, Bernstein & Bernstein.

95th St. and 2d Ave., 4 6-story br. and stone store and tenemt.; c, $125,000; o, Jos. Isaacs; a, Maximilian Zipkes.

99th St. and 1st Ave., 6-story br. and stone store and tenemt.; c, $65,000; o, Kleinfeld & Rothfeld; a, Samuel Sass.

114th St. and Pleasant Ave., 6-story br. and stone store and tenemt.; c, $40,000; o, Barnett Osk; a, Bernstein & Bernstein.

1st Ave. and 100th St., 4 6-story br. and stone tenemts. and stores; total c, $170,000; o, Kleinfeld & Rothfeld; a, Samuel Sass.

68th St. and West End Ave., 3-story br. and stone stable; c, $25.000; o, Wm. Bradley; a, M. V. B. Ferdon.

Park and Wendover Aves., 5-story br. factory; c, $50,000; o, Dressel Railway Lamp Works; a, M. J. Garvin.

Amsterdam Ave. and 167th St., 2 6-story br. and stone stores and tenemts.; total c, $80,000; o, Jacob Goldberg; a, E. A. Meyers.

117th St. and Pleasant Ave., 6-story br. and stone tenemt. and store; c, $42,000; o, David Marks Realty Co.; a, Bernstein & Bernstein.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

West Palm Beach, Fla.—Geo. B. Cluett, of Saratoga, N. Y., it is reported, is contemplating the erection of a residence here to cost about $30,000.

Chicago, Ill.—D. S. Pentecost, 2466 N. Ashland Ave., is preparing plans for an apartment building to be erected at 4718-30 St. Lawrence Ave. for R. J. Bush. It will be 3 stories high and will cost $150,000.

Geo. C. Watts, the builder, has had plans prepared by L. Mart Mitchell, 145 La Salle St., for an apartment building to be erected at Indiana Ave. and 37th St. It will be a 3-story structure, 150x152 ft., and cost $120,000.

Davenport, Ia.—The members of the B'nai Israel congregation, it is stated, are contemplating the erection of a synagogue to take the place of the Temple Emanuel, the cost to be about $20,000.

Louisville, Ky.—The Everton Realty Co., it is stated, intends erecting a 3-story stone and brick apartment house on Walnut and 2d Sts. according to plans prepared by Maury & Hillerick. It is reported that bids for the construction will be received until Nov. 13. The cost of the building, including site, is to be about $350,000. Walter S. Adams is one of the directors.

The Fidelity Trust Co., 210 5th St., has in contemplation the erection of an apartment house on Chestnut St., bet. 4th and 5th Sts., and if such a building is erected D. X. Murphy & Bro., 250 5th St., will be the architects. John W. Barr., Jr., Pres.

Covington, Ky.—Martin Durrett will erect 3 flats, each to cost $15,000.

St. Louis, Mo.—It is stated that bids will be received until Nov. 8 by Cope & Stewardson, Archts., Security Bldg., for erecting a 2-story, 65 x 55-ft. residence for D. C. Cattlin. Cost, $60,000.

Omaha, Neb.—Fisher & Lawrie, Paxton Bldg., it is reported will prepare plans for the new church for the Lowe Ave. Presbyterian congregation. Cost to be about $15,000. Rev. A. S. C. Clarke, pastor.

Rochester, N. Y.—The Bldg. Com. of the Parsells Ave. Baptist Church (O. K. Johnson, Pres.), it is stated, has accepted the plans submitted by Brown & Davis, of Cincinnati, O., for the new edifice which it is proposed erecting of stone at a cost of $100,000.

New York, N. Y.—Architects Armstrong & Jaynor, 1133 Bway, New York, N. Y., are ready to receive figures for a very large improvement to be known as the Banister Realty improvement at Far Rockaway, N. Y. It will include dredging, building bulkheads, sewerage, gas, electric lighting and other improvements, to cost about $500,000. They are also architects for the following work and will be ready for figures in about 15 days. Large improvements and the building of 12 residences at Linden, Md., at a cost of about $450,000. Casino to cost $200,000 and club house to cost $75,000 at Saratoga. They are also in market for figures on improving Mr. DuPont's new property at Concord, Del., at a cost of $100,000. Also will be ready in about 60 days for a seawall at Mrs. John N. Brown's new place at Newport, R. I. They are also preparing plans for a casino at Long Branch.

Brooklyn, N. Y.—It is stated that plans are to be received for the new edifice for the 6th Ave. M. E. Church, the cost to be about $30,000. Rev. Dr. Wellesley W. Bowdish, Pastor.

Nashville, Tenn.—It is reported that plans are being perfected for the new edifice for the Edgefield Baptist Church. Cost, $25,000.

NEW YORK, N. Y.

62d St. and 5th Ave., 6-story br. and stone residence; c, $45,000; o, Edmund L. Baylies; a, Hoppin, Koen & Huntington.

515 E. 117th St., 6-story br. and stone tenemt.; c, $35,000; o, David Marks Realty Co.; a, Bernstein & Bernstein.

Morningside Ave. and 115th St., 2 6-story br. and stone apartment houses; total c, $400,000; o, Paterno Bros.; a, Schwartz & Bross.

Minford Pl. and 172d St., 5-story br. tenemt.; c, $38,000; o, Stephen G. Still; a, Wm. T. La Ville.

161st St. and Jackson Ave., 6-story br. tenemt.; c, $50,000; o, Hawthorne Bldg. Co.; a, Moore & Landsiedel.

Arthur Ave. and Oak Tree Pl., 5-story br. tenemt.; c, $25,000; o, Chas. Bjorkegren; a, Franz Wolfgang.

Hoe Ave. and 167th St., 5-story br. tenemt.; c, $30,000; o, Abraham Silberberg; a, Neville & Bagge.

67th St. and Amsterdam Ave., 2 -story br. and stone tenemt.; total c, $100,000; o, Nierenberg & Jaffe; a, Stern & Morris.

105th St. and 2d Ave., 6-story br. and stone tenemt.; c, $40,000; o, Hyman Levine; a, Bernstein & Bernstein.

SCHOOLS.

Notes Arranged Alphabetically by States.

Phoenix, Ariz.—See "Water."

Mojave City, Ariz.—See "Power Plants, Gas and Electricity."

San Francisco, Cal.—The Bd. of Superv. Oct. 23 passed to print 3 bills, authorizing the immediate construction of the Washington Grammar School, appropriation $119,000; the Laguna Honda School, appropriation $81,000, and the Sunnyside School, appropriation $54,000.

Denver, Colo.—David W. Dryden, Temple Court, it is stated, has completed plans for a 2-story brick and stone school, which is to be erected in Washington Park, at S. Grace and Arizona Sts., at a cost of $25,000.

Grand Junction, Colo.—Bids will be received until Nov. 29 by the Comr. Indian Affairs, (C. F. Larrabee, Acting Comr.), Washington, D. C., for furnishing material and constructing at the Indian School, Grand Junction, Colo., a mess hall and employes' quarters, work shop and superintendent's cottage, all of brick, with plumbing, steam heat and electric wiring; a dairy barn and laundry of brick with plumbing and electric light wiring, and for ventilating and heating 3 large buildings; also for moving and relocating hospital. For further information apply to Chas. E. Burton, Supt., Grand Junction, Colo.

Suffield, Conn.—The Trus. of Conn. Literary Inst., it is stated, are contemplating the remodeling of the dormitory, at a cost of $25,000.

New Haven, Conn.—The Epsilon Assoc. of Yale Scientific School, it is reported, has purchased a site and will erect a dormitory, to cost about $50,000.

Hartford, Conn.—The Trus. of the Washington School Dist., it is stated, have appropriated $50,000 to the Com. on the Washington St. School for an addition to be erected on School St. and authorized the Com. to select an archt. to prepare plans for the same.

**Indianapolis, Ind.*—Contracts for erecting the Indiana Industrial School have been awarded as follows: General construction to John Warren; heating to W. H. Johnson & Son Co.; plumbing to Mr. McCarthy; concrete, to Julius Keller, and brick to Chas. Werkking. Architect, J. T. Johnson, 1113 State Life Bldg.

Pauls Valley, Ind. Ter.—The School Bd., it is stated, has accepted the plans of D. T. Caufman, of Sulphur Springs, for a 6-room and an 8-room brick and stone school, the cost to be $10,000 and $13,000 respectively.

Des Moines, Ia.—A building permit has been granted to erect a $22,000 parochial school at 20th St. and Univ. Ave., to be known as St. John's. Rev. D. F. Mulvihill, Pastor.

**Items marked thus give the names of parties awarded contracts.*

Coffeyville, Kan.—The Bd. of Educ., it is stated, is considering the erection of a high school, to cost about $50,000. An election will probably soon be held to vote on the question.

Everett, Mass.—The City Council has appropriated $97,000 for an addition to the high school. Architect, Loring Phipps, of Boston.

Quincy, Mass.—An order has been introduced in City Council, providing for additions to the present high school, to cost $113,000, from plans of Aaron A. Gould, 43 Milk St., Boston.

Kalamazoo, Mich.—It is stated that the Legislature has appropriated $60,000 for the erection of a new building at the Western Normal School next spring. Prof. Waldo, of the Western Normal School, may be able to give further information.

Brighton, Mich.—It is reported that bids will be received until Nov. 27 by the Bldg. Com., School Dist. No. 27 (B. I. Case, Chmn.) for erecting a ward school.

Purvis, Miss.—Contract will probably be let on Nov. 15 for the erection of a school to cost about $10,000.

Laurel, Miss.—It is reported that bids are wanted Nov. 15 for the erection of a school, to cost about $20,000. W. F. Daly, City Clk.

Webster Groves, Mo.—Bids will be received until Nov. 14 by the Bd. Dirs., School Dist. (F. B. Miller, Secy.) for furnishing material and erecting a building to be known as the Central School on Selma Ave. Tulley & Clark, Archts., Room 813, Security Bldg., St. Louis, Mo.

**Jersey City, N. J.*—Fred Ege, Secy. Bd. Educ., writes that the contract for erecting School No. 30 (bids opened Oct. 26) has been awarded to the Jersey City Bldg & Contr. Co., 586 Newark Ave., for $64,826.

Orange, N. J.—The Bd. of Educ. Oct. 24 adopted the plans for the Central School, which provide for a 3-story structure, to cost about $85,000.

**Brooklyn, N. Y.*—The following are the bids opened on Oct. 30 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for the general construction of School 148, Brooklyn Boro.: P. J. Walsh, $327,000; Frank Berlenbach, $342,579; Richard E. Heningham, 4-5 Court Sq., $316,719 (awarded contract); Chas. H. Peckworth, $317,760; Geo. Hildebrand, $326,700; John Auer & Sons, $318,970; Clarke & Stowe, $323,000; Arci Constr. Co., $327,000; Church Constr. Co., $336,000; Thos. Cockerill & Son, $334,900.

*Chris Nally, 2398 Bway., N. Y. City, secured the contract for the plumbing and drainage of the above building for $2,379.

Port Richmond, S. I., N. Y.—Bids will be received until Nov. 13 by C. B. J. Snyder, Supt. School Bldgs., New York City, for general construction, etc., of School 21, Port Richmond; also installing, ventilating and heating apparatus for additions to and alterations in School 16, Castleton, both in Boro. Richmond.

**Punxsutawney, Pa.*—J. A. Noxon, of Titusville, it is stated, has secured the contract to erect a school here at $52,500. The contract for the heating of said building, it is stated, has been awarded to the American Warming & Ventilating Co., of Pittsburg, at $10,100. It is to be a 3-story structure, of brick and stone.

**Philadelphia, Pa.*—A building permit has been granted to Henderson & Co., 1221 Arch St., to restore tower and astronomical observatory at the Boys' Central High School, which was recently destroyed by fire, the cost to be about $25,000.

The Bd. Trus. of Temple College, it is stated, has secured a site on N. Broad St., on which it is proposed erecting a 4-story building, costing $150,000, which will be used as an addition to the present building on Broad and Berks Sts.

Columbus, O.—Bids will be received until Nov. 20 by the Com. on Bldgs. Bd. Educ. (C. E. Morris, Chmn.) for furnishing material and constructing the Highland, Eastwood and Reeb Ave. Schools. David Reibel, Archt., Eberly Bldg.

Miamisburg, O.—Bids will be received until Nov. 11 by the Bd. Educ., Village School Dist. (John M. Purnell, Clk.) for $50,000 school bonds.

Tomah, Wis.—H. & F. Roettiger, of Fountain City, Wis., it is reported, submitted the lowest bid for the erection of the industrial building and brick dormitory at the Tomah school, at $18,748.

Waukesha, Wis.—The Bd. Trus. of Carroll College, it is stated, has appointed A. J. Frame, Dr. W. C. Carrier and Henry Phelps, all of Waukesha, as a Bldg. Com. to secure plans and specifications for a new dormitory, for which Ralph Voorhees, of New Jersey, has promised $35,000.

Platteville, Wis.—The following are the bids opened on Oct. 26 by the Bd. of Regents, Normal School, Madison, for erecting a normal school at Platteville.

*General construction: General Constr. Co., $117,488; Northern Constr. Co., $109,546; Henry Schlueter, $132,660; Blair & &Sumners, $125,652; Chippewa Falls Con. Co., $111,046; J. A. Silver, Appleton, Wis., $103,720 (awarded contract); Winchester & Cullen, $107,688; Hughes & Eastman, Platteville, Wis., $118,990; Geo. R. Potter, $143,175.

*Ventilating and heating: Downey & Kruse Co., $19,780; W. S. Patterson Co., $19,899; G. A. Kees Dom. Eng. Co., $21,280; Louis & Kitchen, $19,466; Pond & Hasey Co., $21,533; Mueller Co., $19,823; Tunstad Heating Co., $23,890; Dwyer Heating & Plumbing Co., $18,888 (awarded contract).

*Plumbing: H. J. Smiley, $6,200 (awarded contract); W. S. Patterson Co., $6,934.

Milwaukee, Wis.—The plans of Van Ryn & De Gelleke, 211 Grand Ave., it is stated, have been accepted for the 3-story brick and stone State Normal School, which is to be erected at State and 25th Sts., at a cost of about $140,000.

Woodstock, N. B.—The late L. P. Fisher, it is reported, has left about $200,000 for the establishment of a free manual and industrial training school, $40,000 for a town school and equipment, $10,000 for a hospital and $20,000 for a library.

Montreal, Que.—The Catholic Bd. of School Comrs. (Rev. Abbe Troie, Pres.), it is stated, has accepted the plans of Maurice Perrault, 15 St. Lambert St., for the St. Eusebe School, the cost to be about $44,700.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Kittanning, Pa.—The Town Council is reported to have granted Henry Rader a franchise for the disposal of garbage. It is stated that he will construct a garbage furnace outside the limits of the borough on his farm.

St. Louis, Mo.—The Bd. of Pub. Improv. (A. J. Reilly, Pres.) is reported to have under consideration the construction of an incinerating plant for garbage, to cost about $120,000.

Detroit, Mich.—The Bd. of Estimate on Oct. 27 finally adopted the resolution authorizing the issue of $100,000 bonds for the construction of a city garbage plant.

York, Pa.—The only bid received and opened on Oct. 27 by the Sanitary and Highway Committees, for the collection and removal of garbage, was submitted by E. S. Williamson and G. W. Hunter, of Philadelphia. They bid for collecting and disposing of inorganic and organic garbage for a period of 10 years as follows: First 5 years from the first Monday of April, 1906, for $18,000 per yr., and for the remaining 5 years, $18,000 per yr. and $2.50 additional for every dwelling or building erected within the city limits after the first Monday of April, 1911, that makes or causes to be made inorganic or organic garbage, providing they are awarded both the contracts for the collection and disposal of inorganic and organic garbage. They also propose to dispose of the organic garbage for a period of 10 years without cost to the city, providing they are awarded the contract for removal and disposal of organic and inorganic garbage.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

The McGehee Lumber Co., Summerfield, Fla., will shortly increase its plant by the addition of two dry kilns having a capacity of 20,000 ft., and 3 planers. This company is also in the market for a second-hand planing mill with boiler and engine.

The Lagonda Mfg. Co., Springfield, O., has purchased a site for the erection of a new building, measuring 200 x 50 ft., 1 story high. The new building, which will greatly increase the capacity of the present plant, will be constructed of concrete and steel.

Keeler Brass Co., Grand Rapids, Mich., is increasing the capacity of its plant and is in the market for dynamos, motors, milling and drilling machinery, shafting, etc.

Locke Insulator Mfg. Co., Victor, N. Y., will erect a new 2-story building, measuring 160 x 180 ft., and will install a power plant with a capacity of 200 h.p.

The Ozark Orchard & Investment Co., Gravette, Ark., will in the spring erect a 40,000-bbl. cold storage plant. A cider, vinegar and canning factory will also be built.

American Pin Co., Waterbury, Conn., is having plans prepared for an addition to its plant.

Morris Machine Works, Baldwinsville, N. Y., is erecting a new shop, 35 x 216 ft. Upon completion of this building an additional machine shop will be constructed, to measure 58 x 150 ft. New boiler plant of 100-h.p. capacity will be required.

The Dealers' Steam Packing Co., Palmyra, N. Y., is erecting a new building, which will give 15,000 sq. ft. additional floor space. Two 40-h.p. boilers will be required.

Guyan Valley Fuel Co., Huntington, W. Va., is building a new plant and will install engines for handling barges together with rope haul for pulling cars into the tipple. This company is in the market for a locomotive.

Wilshusen Disc Sled Works, Stafford, Kan., is erecting a new foundry, and would like to receive catalogues of machinery dealers.

The Mullen Mfg. Co., engineers and machinists, Baltimore, Md., is building a new plant. Amount of power equipment to be installed not yet determined. This company is in the market for machine shop equipment, including lathes, drills, shapers, etc.

Livingston Mfg. Co., Rockland, Me., is erecting a new building to be used as forge shop and machine shop. This company is in the market for new machinery.

Brooklyn (N. Y.) Range Boiler Co. is building a new plant measuring 175 x 180 ft. Power plant of 50-h.p. will be required.

The Dicke Tool Co., Downers Grove, Ill., will rebuild its recently burned plant. The new plant will consist of machine and wood shops, 150 x 40 ft., 2 stories, blacksmith shop 38 x 38 ft., 1 story, and office building and warehouse. This company contemplates installing a fuel oil engine for operating its new plant.

Fawcus Machine Co., Pittsburg, Pa., has purchased site and is preparing plans for a new 2-story machine shop, to have a length of 120 ft.

American Horticultural Distributing Co., Martinsburg, W. Va., mfrs. of soluble oils and insecticides, is building a new factory which will greatly increase its output.

The Winget Concrete Machine Co., Columbus, O., will build a new plant at Plain City. New building will measure 50 x 220 ft. and include machine shop and foundry space.

Mr. J. O. H. Bennette, Conroe, Tex., will establish a lumber plant having a capacity of 20,000 ft. per day. Steam power plant will be installed.

William C. Finck Co., Elizabeth, N. J., will build a factory measuring 50 x 90 ft. Power plant of 25-h.p. will be required.

Willow Grove Milling Co., Luray, Va., is contemplating the installation of additional rolls and sifters in the early spring.

Mr. A. V. Lones, Texarkana, Tex., is arranging for the establishment of a sewer pipe manufacturing plant at that point for L. W. Post, of the Blackmer & Post Pipe Co., St. Louis, Mo.

The Kimberly & Clark Co., Quinnesec, Wis., is contemplating increasing the capacity of their ground wood plant from 75 to 125 tons per day, according to local reports.

The Acker Process Co., Niagara Falls, N. Y., will establish a new plant at Buffalo, according to local reports.

The Standard Paper Co., Toronto, Ont., is negotiating for a site in the town of Cannington for the erection of a paper mill to employ about fifty men, according to local reports.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Phoenix, Ariz.—See "Water."

San Francisco, Cal.—The following are the bids opened on Oct. 31 by the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for dredging 20,000 cu. yds. at the Navy Yard, Mare Island (price given per cu. yd.): North American Dredging Co., 25.98 cts.; Pacific Coast Dredging & Reclamation Co., 25 cts., and San Francisco Bridge Co., 25 cts.

**Los Angeles Cal.*—D. W. Murphy, Acting Superv. Engr., U. S. Reclamation Service, Los Angeles, writes that the contract for furnishing from 30,000 to 80,000 bbls. Portland cement, f. o. b. Tolenso (bids opened Sept. 30), has been awarded to Pacific Portland Cement Co., of San Francisco, at $1.55 per bbl.

Oakland, Cal.—Bids will probably be called for by the Bd. of Pub. Wks. (W. B. Fawcett, Secy.) the latter part of November or in December, for the dredging of Lake Merritt; probable cost of work $50,000. F. C. Turner, City Engr.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Washington, D. C.—U. S. Secy. Taft has transmitted to the Treas. Dept. his estimates of the appropriations required for the fiscal year ending June, 1907. Under the head of public works, military and civil, which includes the construction of sea coast fortifications, military posts, etc., and the improvement of rivers and harbors, of various national parks throughout the country, and of certain public buildings and grounds in and around Washington, the estimates call for appropriations amounting in the aggregate to **$27,016,129.**

Bids will be received until Nov. 21 at the Bureau Supplies and Accounts, Navy Dept., Washington, to furnish at the Navy Yards, Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; Norfolk, Va.; Puget Sound, Wash.; Mare Island, Cal., and Pensacola, Fla., 45,500 ft. B. M. of white oak; applications for proposals should refer to Schedule 203. H. T. B. Harris, Paymaster Gen., U. S. N.

Bids will be received until Nov. 16 by Brig. Gen. Wm. Crozier, Ch. Ordnance, War Dept., Washington, for supplying Ordnance Dept., U. S. A., with 16,800 shovels, 5,600 pick mattocks and 3,000 hand axes of especial design.

The following are the totals of the bids opened on Oct. 30 by R. L. Hoxie, Corps Engrs., U. S. A., for dredging in Potomac River; about 340,000 cu. yds.: Atlantic, Gulf & Pacific Co., New York, N. Y., $49,640; Coastwise Dredging Co., Norfolk, $61,200, and Sanford & Brooks Co., Baltimore, Md., $57,800.

Bids will be received until Nov. 14 at the Bureau Supplies and Accounts, Navy Dept., Washington, to furnish at the Navy Yard, New York, N. Y., and the Naval Station, Cavite, P. I., plain and corrugated galvanized sheet steel, tool steel, steel bars, sheet brass and copper, bar iron, iron pipe, pipe fittings, etc. Applications for proposals should refer to Schedule 210; also same date at the Navy Yards, League Island, Pa., and Norfolk, Va., a quantity of machine tools, etc., as follows: Schedule 197: Tenoning machine, cut-off saw and turntables. Schedule 198: Metal and oil separator, pipe cutting machine, planer and lathe. Applications for proposals should designate the Schedules desired by number. H. T. B. Harris, Paymaster-Gen., U. S. N.

Chicago, Ill.—Bids will be received until Nov. 17 by the Dept. Pub. Wks. (J. M. Patterson, Comr.) for furnishing and delivering at the 22d St. pipe yard approximately 25,000 ft. 1-in. lead pipe at 4 lb. per ft., 1,000 ft. 1¼ in. lead pipe at 4¾ lb. per ft., 1,000 ft. 1½-in. lead pipe at 6 lb. per ft., and 1,000 ft. 2-in. lead pipe at 8 lb. per ft.

Bids will be received until Nov. 8 by the Bd. Trus., Sanitary Dist., Chicago (S. D. Griffin, Clk.), for $1,000,000 purchasing bonds.

Sycamore, Ill.—Bids will be received by E. L. Springs, City Clk., until Nov. 13 for the installation of a first-class fire alarm system, as advertised in The Engineering Record.

**Clarinda, Ia.*—W. S. Jordan, Co. Aud., writes that the contract for constructing a drain in Colfax Township (bids opened Oct. 23) has been awarded to C. D. Johnson, of Blanchard, Ia., for $2,028.

Centerville, Ia.—The Bd. of Supervisors is reported to have decided to construct a drainage ditch from Chariton River, about 5 miles in length; probable cost, $30,000.

New Orleans, La.—Bids will be received by Capt. J. F. McIndoe, Corps Engrs., U. S. A., until Nov. 27 for dredging a channel near the west shore of Sabine Lake, connecting Sabine and Neches Rivers with Taylor's Bayou, Tex., and for constructing creosoted wooden revetment, as advertised in The Engineering Record.

New Orleans, La.—Only one bid was received and opened on Oct. 24 by the Bd. of State Engrs. at New Orleans for the Morancy Levee, Parish of Madison, 65,000 cu. yd. at 19.25 cts. per cu. yd., which was rejected as being high.

*C. Harrison Parker, of Baton Rouge, secured contracts for Lake Palmyra Levee, Section 1, 2 and 3, about 255,000 cu. yd., at 14.75 cts. per cu. yd. Patk. Adams secured the contract for the Reddick Levee, 7,000 cu. yd., at 16.99 cts. per cu. yd., and J. S. Higdon, of Alexandria, secured the contract for the Long Branch Levee, 37,000 cu. yd., 14 cts. per cu. yd. (bids opened Oct. 24 by the Bd. of State Engrs., New Orleans).

Portland, Me.—The following are the bids opened on Oct. 9 by Lieut. Col. W. M. Black, Corps Engrs., U. S. A., for dredging in Cocheco River, N. H., (*a*) 16,718 cu. yd. dredging, (*b*) 36 cu. yd. rock excav.: Bay State Dredging Co., Boston, Mass., *a* 65 cts., *b* $25; Simon J. Donovan, Boston, Mass., *a* 65 cts., *b* $15.

Boston, Mass.—The following are the bids opened on Oct. 27 by the Harbor and Land Comrs., Room 131, State House, for dredging about 35,000 cu. yds. material from a channel in Dorchester Bay: Eastern Dredging Co., 247 Atlantic Ave., Boston, 25 cts. per cu. yd.; N. E. Dredging Co., 185 Summer St., Boston, 23.8 cts.

**Detroit, Mich.*—John Mercier & Co., Hammond Bldg., is reported to have secured from the Michigan State Telephone Co. the contract for laying 3 miles of conduits from 24th St. to Woodmere; also 3 miles of conduits in the city of Yipsilanti, for a total of about $40,000.

**Items marked thus give the names of parties awarded contracts.*

The Michigan Telephone Co. is reported to have under consideration the placing of the Michigan Ave. lines in the conduits early next year, and will lay about 10 miles of underground work in that thoroughfare.

Minneapolis, Minn.—Walter S. Pardee, Archt. Engrs. Dept,. City Hall, has prepared plans for a parkway around the Northeast Pumping Station.

Billings, Mont.—Bids will be received at the office of the Engineer, U. S. Reclamation Service, Billings, until Dec. 15 for installing a telephone system having 8 or more telephone stations and 22 miles or more of pole line, as advertised in The Engineering Record.

Lincoln, Neb.—The Otis Elevator Co., of New York, N. Y., has secured the contract for the installation of an electric passenger elevator and hydrants lifts in the U. S. Court House (bids opened Oct. 19) for $10,840.

New York, N. Y.—The following are the bids opened Oct. 27 by Lieut. Col. W. L. Marshall, Corps Engrs., U. S. A., for furnishing rip rap and enlarging sea wall at south end of U. S. lands at Sandy Hook, N. J.; Each contractor submitted two bids (*a*) for 25,000 tons of stone to be delivered within 25 ft. from trestle; (*b*) 25,000 tons of stone, 25 ft. or more from trestle (price given per ton): The Abbot Gamble Co., 23 Bway., *a* and *b* $2.265; Stacy B. Opdyke, Jr., 1930 Bway, *a* $3.60, *b* $5.40; Merrit W. Pharo, Philadelphia, Pa., *a* $1.98, *b* $2.42; Bouker Contracting Co., 21 State St., *a* and *b*, $1.94; Brown & Fleming Contr. Co., 129 Broad St., *a* and *b*, $1.74½; Leslie McHarg & Co., 299 Bway., *a* $2.36, *b* $2.49; Bell Eng. & Constr. Co., 220 Bway., *a* $2.05, b $2.15.

New York, N. Y.—See "Churches and Dwellings."

Brooklyn, N. Y.—Bids will be received until Nov. 15 (change of date by Martin W. Littleton, Pres. Brooklyn Boro., for furnishing materials and constructing a flushing tunel and intake and appurtenances for improving the sanitary condition of Gowanus Canal in DeGraw St., from East River to Hoyt St.; Hoyt St., from DeGraw to Butler Sts.; Butler St., from Hoyt St. to Gowanus Canal. Engineer's estimate of the quantities is as follows: 6,270 lin. ft. flushing tunnel; 8,200 cu. yds. additional brick masonry around flushing tunnel, built in tunnel contsr.; 4,100 cu. yds. additional concrete masonry around flushing tunnel, built in tunnel constr.; 1,600 cu. yds. concrete masonry in and about intake and outfall; 4,500 cu. yds. excav. in and about intake and outfall; 8,500 lin. ft. bearing piles; 1,250 lin. ft. tender piles; 113 M. ft. temporary sheet piling; 182 M. ft. permanent sheet piling; 280 M. ft. found. plank; 20 M. ft. pile capping; 280 ft. sheeting and bracing; 900 lin. ft. 12-in., 60 lin. ft. 15-in., 560 lin. ft. 18-in., and 680 lin. ft. 24-in. pipe sewer; 20 lin. ft. 36-in. and 20 lin. ft. 60-in. brick sewer; 20 manholes; 1,800 lin. ft. 6-in. house connection pipe drain; 264 sq. ft. bluestone coping; 280 lin. ft. granite coping; 6,400 lin. ft. 12-in. pipe sub-drain; 35 tons steel "I" beams; 6.5 tons wrought iron; 33 tons cast iron; 28.5 tons steel rods, and 5,000 cu. yds. dredging.

Brooklyn, N. Y.—See "Public Buildings."

Troy, N. Y.—Bids will be received until Nov. 10 by Wm. H. Gearin, Compt., for $28,000 Propect Park bonds.

Panama.—The Bucyrus Co., of South Milwaukee, Wis., have secured from the Panama Canal Comn. the contract for nineteen 75-ton steam shovels, at $10,000 each.

Norristown, Pa.—Bids will be received until Nov. 15 by the Boro. Engr. for the erection complete of a fire-alarm or whistle tower, 100 ft. high, price to include the transfer of the bell and striking apparatus from City Hall tower to the new one, as advertised in The Engineering Record.

Philadelphia, Pa.—Bids will shortly be called for by A. Lincoln Acker, Dir. Dept. Pub. Wks., for the construction of the ship channel in Delaware River, between Marcus Hook and Christian St. Wharf, to a full depth of 30 ft. and 600 ft. wide. The State Legislature is reported to have appropriated $375,000 for this work.

Scranton, Pa.—Mayor Connell on Oct. 23 signed the ordinance appropriating $50,000 for a new fire and police alarm system.

Houston, Tex.—Bids will be received until Nov. 13 by John B. Ashe, Co. Aud., for the drainage of a ditch from the Westfield Link road to intersect the Kuykendahl and Egypt public road.

Galveston, Tex.—U. S. Secy. Taft on Oct. 20 decided to favor allowing the expenditure of $75,000 for beginning the work of improving Brazos River. It will ultimately cost several millions if the entire project is approved by future legislation.

Ft. Douglas, Utah.—Bids will be received until Nov. 14 by Col. C. A. H. McCauley, Ch. Q. M., U. S. A., Denver, Colo., for furnishing material and constructing about 9 miles of barbed wire fence around original military reservation and about 16 miles of barbed wire fence around the water reserve portion military reservation at Ft. Douglas.

National Soldiers' Home, Va.—Bids will be received until Nov. 14 at the office of B. A. Beeson, Treas., N. H., D. V. S., for dredging about 9,000 cu. yds. sand in front of sea wall.

Auckland, New Zealand.—Bids will be received at the office of the Harbour Board (J. M. Brigham, Secy.) until Jan. 9 for foundations and erection of Sheerlegs and for jetty in re-inforced concrete at Calliope Dock Yard, Auckland Harbour, as advertised in The Engineering Record.

PROPOSALS OPEN

For Proposals see pages 57, 76, 78, 80 and 88.

WATER WORKS.

Bids Clos.		See Eng. Record.
Nov. 7.	Tank, etc., Ft. Stevens, Ore	Oct. 21
Nov. 7.	Boilers, etc., St. Louis, Mo	Oct. 21
Nov. 7.	Additions to pump sta., Toronto, Ont.	Nov. 4
Nov. 7.	Exten. to mains, Decatur, Ind	Nov. 4
Nov. 8.	Irrig. canal, Mitchell, Neb Adv. Oct. 14 to Nov. 4.	Oct. 14
Nov. 8.	Canal work, North Platte, Neb Adv. Oct. 14 to Nov. 4.	Oct. 14
Nov. 8.	Boilers, Brooklyn, N. Y	Oct. 21
Nov. 8.	Filter beds, Brooklyn, N. Y	Oct. 28
Nov. 8.	Mains, New York, N. Y	Oct. 28
Nov. 8.	Boilers, Detroit, Mich.	Nov. 4
Nov. 9.	Mains, etc., Ft.. Walla Walla, Wash.	Nov. 4
Nov. 9.	Conduit, Salt Lake City, Utah	Nov. 4
Nov. 10.	C. I. pipe, Cincinnati, O	Oct. 14
Nov. 10.	System, Norfolk, Va	Nov. 4
Nov. 11.	System, East Moline, Ill	Oct. 21
Nov. 11.	Filters, etc., Panama	Oct. 28
Nov. 11.	Hydrants, etc., Ft. Williams, Me	Nov. 4
Nov. 14.	Pipe laying, Lincoln, Cal	Nov. 4
Nov. 15.	Canals, etc., Buford, N. D Adv. Sep. 30 to Nov. 4.	Sep. 30
Nov. 15.	Filter plant, Independence, Kan Adv. Oct. 21.	Oct. 21
Nov. 15.	Water wks. and filtration plant, Milledgeville, Ga. Adv. Oct. 28 to Nov. 4.	Oct. 28
Nov. 16.	Reservoir, etc., Lebanon, Pa Adv. Nov. 4.	Oct. 28
Nov. 22.	Exten. of system, Vancouver Barracks, Wash.	Nov. 4
Nov. 22.	Fire mains, New York, N. Y	Nov. 4
Nov. 22.	Boilers, etc., Phoenix, Ariz	Nov. 4
Nov. 25.	Reservoir, Ft. Miley, Cal	Nov. 4
Nov. 27.	Boiler etc., Ft. Screven, Ga **Adv. Nov. 4.**	Nov. 4
Nov. 27.	Pipe, etc., Portland, Ore Adv. Nov. 4.	Nov. 4
Dec. 1.	Water works, Burlington, Wash	Oct. 14
Dec. 1.	Meters, Chicago, Ill.	Oct. 21
Dec. 1.	Water wks., Ballinger, Tex	Oct. 28
Dec. 5.	Dam, Glendive, Mont. Adv. Sep. 16 to Oct. 21.	Sep. 16
Dec. 15.	Canal work, Billings, Mont Adv. Oct. 21 to Nov. 4.	Oct. 21
Dec. 29.	Canal, etc., Klamath Falls, Ore Adv. Nov. 4.	Nov. 4
Jan. 1.	Irrig. work, El Campo, Tex	Oct. 7
Jan. 2.	Water wks., Manila, P. I.	Sep. 30
———	Tunnel, c. i. pipe, etc., Harrisburg, Pa. **Adv. Oct. 7.**	Oct. 7

SEWERAGE AND SEWAGE DISPOSAL.

Bids Clos.		See Eng. Record.
Nov. 7.	Guantanamo, Cuba	Oct. 14
Nov. 7.	Chattanooga, Tenn. Adv. Oct. 14, 21.	Oct. 14
Nov. 7.	Clinton, Ill.	Oct. 28
Nov. 7.	Tipton, Ind.	Oct. 28
Nov. 8.	Kearny, N. J.	Nov. 4
Nov. 8.	St. Bernard, O.	Nov. 4
Nov. 9.	Boise City, Idaaho	Nov. 4
Nov. 10.	Aberdeen, S. D.	Oct. 21
Nov. 11.	Ft. Williams, Me.	Nov. 4
Nov. 15.	Brooklyn, N. Y.	Nov. 4
Nov. 16.	Des Moines, Ia.	Nov. 4
Nov. 20.	Webb City, Mo Adv. Oct. 28 to Nov. 4.	Oct. 28
Nov. 22.	Vancouver Barracks, Wash	Nov. 4
Nov. 25.	Elyria, O. Adv. Nov. 4	Nov. 4
Nov. 30.	Baton Rouge, La Adv. Oct. 28 to Nov. 4.	Oct. 28
Nov. —.	Rockport, Ind.	Oct. 7
Dec. 11.	Sheldon, Ia.	Oct. 14
Jan. 12.	Manila, P. I.	Sep. 30
———	Kirkwood, Mo. Adv. Sep. 30.	Sep. 30
———	Haddonfield, N. J.	Oct. 14
Feb. 1.	Woodlawn, Ala	Oct. 28

BRIDGES.

Bids Clos.		See Eng. Record.
Nov. 7.	Bloomfield, Ind.	Oct. 21
Nov. 7.	Palmyra, Mo.	Oct. 21
Nov. 7.	Fargo, N. D.	Oct. 28
Nov. 7.	Portage, Wis.	Oct. 28
Nov. 8.	South Bend, Ind.	Oct. 14
Nov. 8.	Audubon, Ind.	Oct. 21
Nov. 8.	Vale, Ore.	Oct. 21
Nov. 8.	Welcome, Wash.	Oct. 28
Nov. 8.	Farmington, Mo.	Nov. 4
Nov. 9.	Columbus, O.	Oct. 21
Nov. 9.	Jefferson City, Mo	Oct. 28
Nov. 9.	Ventura, Cal.	Oct. 28
Nov. 9.	Chicago, Ill.	Nov. 4
Nov. 9.	Boston, Mass.	Nov. 4
Nov. 10.	Argenta, Ark.	Nov. 4
Nov. 11.	Indianapolis, Ind.	Nov. 4
Nov. 20.	Memphis, Tenn. Adv. Oct. 14 to Nov. 4.	Oct. 28
Nov. 20.	Doylestown, Pa.	Oct. 28
Jan. 1.	Pensacola, Fla.	Sep. 30

PAVING AND ROADMAKING.

Bids Clos.		See Eng. Record.
Nov. 6.	Perth Amboy, N. J	Oct. 28
Nov. 7.	Bloomfield, Ind.	Oct. 21
Nov. 7.	Mooresville, Ind.	Nov. 4
Nov. 8.	Verona, N. J.	Oct. 28
Nov. 8.	Cleveland, O.	Nov. 4
Nov. 9.	Cincinnati, O.	Oct. 21
Nov. 9.	New York, N. Y	Nov. 4
Nov. 9.	Allegheny, Pa.	Nov. 4
Nov. 10.	Cincinnati, O.	Oct. 14
Nov. 10.	Indianapolis, Ind.	Nov. 4
Nov. 10.	Bloomington, Ill.	Nov. 4
Nov. 11.	Cleveland, O.	Oct. 28
Nov. 13.	Atlantic City, N. J Adv. Nov. 4.	Nov. 4
Nov. 14.	Shreveport, La.	Nov. 4
Nov. 15.	Brooklyn, N. Y	Nov. 4
Nov. 16.	Des Moines, Ia	Nov. 4
Nov. 20.	Webb City, Mo. Adv. Oct. 28 to Nov. 4.	Oct. 28
Nov. 23.	Cincinnati, O.	Nov. 4
Nov. 24.	Cincinnati, O.	Nov. 4
Nov. 25.	New Orelans, La.	Oct. 21
Nov. 30.	Baton Rouge, La Adv. Oct. 28 to Nov. 4.	Oct. 28
Nov. —	Harrison, N. J.	Oct. 21
Dec. 1.	Mattoon, Ill.	Oct. 21

POWER, GAS AND ELECTRICITY.

Bids Clos.		See Eng. Record.
Nov. 7.	Washington, D. C	Oct. 28
Nov. 8.	Washington, D. C. Adv. Sept. 30 to Nov. 4.	Sep. 30
Nov. 10.	Danville, Pa. Adv. Oct. 28.	Oct. 28
Nov. 10.	Warsaw, Mo. Adv. Nov. 4.	Nov. 4
Nov. 13.	New York, N. Y	Nov. 4
Nov. 14.	Jacksonville, Fla.	Nov. 4
Nov. 14.	Shenandoah, Va.	Nov. 4
Nov. 14.	Washington, D. C	Nov. 4
Nov. 16.	Castleton, S. I., N. Y	Oct. 28
Nov. 18.	**Tacoma, Wash.**	**Sep. 30**
Nov. 18.	Philadelphia, Pa.	Nov. 4
Nov. 18.	Freeport, Ill.	Nov. 4
Nov. 21.	Washington, D. C.	Oct. 21
Nov. 21.	Pensalcola, Fla.	Nov. 4
Nov. 28.	Mojave City, Ariz	Nov. 4
Dec. 2.	**San Juan, Porto Rico**	**Aug. 19**
Dec. 2.	Ft. D. A. Russell, Wyo Adv. Nov. 4.	Nov. 4
Dec. 27.	Lockport, Ill.	Nov. 4

BUILDINGS.

Bids Clos.		See Eng. Record.
Nov. 6.	School, Brooklyn, N. Y	Oct. 28
Nov. 6.	School, New York, N. Y	Oct. 28
Nov. 7.	Htg. post office, Guthrie, Okla. Ter Adv. Oct. 21 to 28.	Oct. 21
Nov. 7.	Htg. hospital, San Jose, Cal	Oct. 21
Nov. 7.	Htg., etc., jail, Bloomfield, Ind	Oct. 21
Nov. 7.	School, Manhattan, Kan	Oct. 28
Nov. 8.	School, Boston, Mass	Oct. 28
Nov. 8.	Alter. City Hall, Baltimore, Md	Nov. 4
Nov. 8.	Residence, St. Louis, Mo	Nov. 4
Nov. 9.	Court house, Marion, Kan	Oct. 14
Nov. 10.	Post Office, St. Johns, Que	Oct. 28
Nov. 11.	School, Sun River, Mont	Oct. 28
Nov. 11.	School, Miamisburg, O.	Oct. 28
Nov. 11.	Office bldg., St. Louis, Mo	Nov. 4
Nov. 13.	Htg. etc., Reformatory, Elmira, N. Y. Adv. Nov. 4.	Nov. 4
Nov. 13.	Pub. bldgs., Montgomery, Ala	Nov. 4
Nov. 13.	School, Port Richmond, S. I., N. Y.,	Nov. 4
Nov. 14.	P. O. bldg., Colorado Spgs., Colo Adv. Sep. 23 to Sep. 30.	Sep. 23
Nov. 14.	Drill hall, Ft. Des Moines, Ia Adv. Oct. 21 to Nov. 4.	Oct. 21
Nov. 14.	Boilers in Hsp., Brooklyn, N. Y	Nov. 4
Nov. 14.	School, Webster Grove, Mo	Nov. 4
Nov. 15.	School, Cleveland, O.	Sep. 16
Nov. 15.	Plumb. P. O., Burlington, Ia	Oct. 21
Nov. 15.	Jail, Lumpkin, Ga.	Oct. 28
Nov. 15.	Bus. bldgs., Florala, Ala	Oct. 28
Nov. 15.	Pub. bldgs., Tompkinsville, S. I,. N. Y.	Oct. 28
Nov. 15.	School, Laurel, Miss	Nov. 4
Nov. 15.	Jail, Homer, Gaa	Nov. 4
Nov. 15.	School, Purvis, Miss	Nov. 4
Nov. 17.	Pub. bldg., New York, N. Y	Nov. 4
Nov. 18.	Htg., Pub. Bldg., Phila., Pa	Oct. 28
Nov. 20.	School, Danbury, Ia.	Oct. 28
Nov. 20.	Park casino, Detroit, Mich	Nov. 4
Nov. 20.	School, Columbus, O.	Nov. 4
Nov. 21.	Post bldgs., Pipestone, Minn	Oct. 28
Nov. 22.	Htg., P. O. Bldg., Evanston, Wyo Adv. Oct. 21 to 28.	Oct. 21
Nov. 22.	School, Phoenix, Ariz.	Nov. 4
Nov. 23.	Hospital, Ft. Michie, N. Y	Nov. 4
Nov. 27.	Improv., Quarantine Sta., Tampa, Fla.	Oct. 28
Nov. 27.	Hospital, Pensacola, Fla	Oct. 28
Nov. 27.	School, Brighton, Mich.	Nov. 4
Nov. 28.	Jail cells, Kansas City, Mo	Oct. 28
Nov. 28.	Pump house, Ft. Du Pont, Del **Adv. Oct. 28 to Nov. 4.**	Oct. 28
Nov. 28.	Court House, Enid, Okla. Ter	Nov. 4
Nov. 28.	School, Mojave City, Ariz	Nov. 4
Nov. 29.	Post bldg., West Point, N. Y Adv. Oct. 21 to 28..	Oct. 21
Nov. 29.	School, Grand Junction, Colo	Nov. 4
Dec. 1.	Dwelling, Wilmington, N. C	Sep. 16
Dec. 2.	Drill hall, Ft. D. A. Russell, Wyo **Adv. Nov. 4.**	Nov. 4
Dec. 2.	Pub. bldg., Philadelphia, Pa	Nov. 4
Dec. 12.	Remodel. capitol, Bismarck, N. D	Sep. 30
Dec. —	School, Bloomington, Ind.	Oct. 21
Jan. 1.	Hotel, Davenport, Ia.	Sep. 30
Jan. 10.	Library plans, Toronto, Ont.	Sep. 23
Jan. —	Hotel annex, Louisville, Ky	Nov. 4

MISCELLANEOUS.

Bids Clos.		See Eng. Record.
Nov. 6.	Garb. disp., **New York, N. Y.** Adv. Sept. 9 to Nov. 4.	Sep. 2
Nov. 7.	Supplies, Guantanamo, Cuba	Oct. 14
Nov. 7.	Boiler, Ft. Brown, Tex	Oct. 21
Nov. 7.	Supplies, Washington, D. C	Oct. 28
Nov. 8.	Elevator in court house, Muncie, Ind.,	Oct. 28
Nov. 9.	**Wharf, etc., Havana, Cuba**	**Jul. 29**
Nov. 11.	Remov. earth and rock, Portsmouth, N. H.	Oct. 21
Nov. 11.	Iron, etc., Panama	Oct. 28
Nov. 13.	Fire alarm system, Sycamore, Ill Adv. Nov. 4.	Oct. 28
Nov. 13.	Ditch, Houston, Tex	Nov. 4
Nov. 14.	Pipe gallery in hsp., Brooklyn, N. Y.	Nov. 4
Nov. 14.	Supplies, Washington, D. C	Nov. 4
Nov. 14.	Fence, Ft. Douglas, Utah	Nov. 4
Nov. 14.	Dredging, Nat. Soldiers' Home, Va	Nov. 4
Nov. 15.	Fire alarm tower, Norristown, Pa Adv. Nov. 4.	Nov. 4
Nov. 15.	Canal Improv., Brooklyn, N. Y	Nov. 4
Nov. 16.	Shovels, etc., Washington, D. C	Nov. 4
Nov. 17.	Lead pipe, Chicago, Ill	Nov. 4
Nov. 18.	Cables, Philadelphia, Pa	Oct. 28
Nov. 20.	Concrete wall, Chattanooga, Tenn Adv. Oct. 14 to Nov. 4.	Oct. 14
Nov. 21.	Supplies, Washington, D. C	Oct. 21
Nov. 21.	Supplies, Guantanamo, Cuba	Oct. 28
Nov. 21.	Lumber, Washington, D. C	Nov. 4
Nov. 22.	Cement, etc., Phoenix, Ariz	Nov. 4
Nov. 23.	Tanks, Ft. Mott, N. J Adv. Oct. 28 to Nov. 4.	Oct. 28
Nov. 25.	Drains, etc., New Orleans, La	Oct. 21
Nov. 27.	Wharf, Pensacola, Fla	Oct. 28
Nov. 27.	Dredging, New Orleans, La Adv. Nov. 4.	Nov. 4
Nov. 28.	Supplies, Washington, D. C	Oct. 28
Dec. 2.	Quay wall, Key West, Fla	Oct. 21
Dec. 2.	Quay wall, Guantanamo, Cuba	Oct. 21
Dec. 15.	Telephone system, Billings, Mont Adv. Nov. 4.	Nov. 4
Dec. 15.	R. R. franchise, Manila, P. I	Nov. 4
Jan. 1.	**Statue plans, Indianapolis, Ind**	**Jul. 22**
Jan. 9.	Wharf, etc., Auckland, N. Z Adv. Oct. 14 to Nov. 4.	Oct. 14
Jan. 9.	Jetty work, etc., Auckland, N. Z Adv. Nov. 4.	Nov. 4
Apr. 2,	**'06. Harbor Work, Valparaiso, Chili,** Adv. Apr. 29 to Sep. 9.	**Apr. 29**
———	Grading, Baltimore, Md. Adv. Sep. 30 to Oct. 7.	Sep. 30
———	Ditch work, Pomona, Ill Adv. Oct. 28 to Nov. 4.	Oct. 28

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